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5c. CAPITAL NEEDS DEVELOPED  
AT THE CORRIDOR LEVEL:  
NORTH SHORE

prepared by

THE EXECUTIVE OFFICE OF TRANSPORTATION &amp; CONSTRUCTION

for presentation to

THE TRANSIT DEVELOPMENT COMMITTEE

of the ADVISORY BOARD to the MBTA

WORKSHOP: APRIL 13, 1976.

This document has been prepared as part of the development of the Revised Program for Mass Transportation, 1976. The Staff Reports are prepared with the cooperation of the Central Transportation Planning Staff, The Massachusetts Bay Transportation Authority, and the Advisory Board to the MBTA.

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FREDERICK P. SALVUCCI  
SECRETARY

# *The Commonwealth of Massachusetts*

*Executive Office of Transportation & Construction*

*One Ashburton Place*

*Boston, Massachusetts 02108*

## MEMORANDUM

TO: Representative James Smith, Chairman April 8, 1976  
Advisory Board Transit Development Committee

FROM: Matthew A. Coogan  
Director of MBTA Systems Planning

RE: Transmittal of Staff Report #5c

I am pleased to transmit Staff Report #5c - "Capital Needs as developed at the Corridor Level: The North Shore"; prepared for review of the Transit Development Committee. This paper has been prepared for presentation at the Workshop to be held on Tuesday April 13 at 7:30 p.m. at Salem City Hall.

The Staff Report presents a summary of Alternatives Analysis process undertaken as part of the MBTA's North Shore Transit Improvements Study currently in progress. The data and conclusions of that study must be taken as preliminary in nature, for the study has several months of additional work to complete. Thus, the data presented in this Staff Report is subject to considerable further refinement and revision as the PMT planning process continues. In addition to reporting on the content of the North Shore Transit Improvements Study, Staff Report 5c includes additional analysis supplied by the CTPS and EOTC staffs.

Please note that Workshop 5c will take place on Tuesday April 13 rather than Wednesday as originally scheduled, in order to avoid conflicts with religious observances. Three more PMT workshops are scheduled as follows:

Thursday - April 22 - CTPS - 4-6 PM - #5d - West and Core  
Thursday - April 29 - CTPS - 4-6 PM - #6 - Management Policy  
Thursday - May 6 - CTPS - 4-6 PM - #7 - Budget and Priority Issues

We look forward to the active participation of your committee in Workshop #5c.





# STAFF REPORT



## 5c. CAPITAL NEEDS DEVELOPED AT THE CORRIDOR LEVEL: NORTH SHORE

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THE EXECUTIVE OFFICE OF TRANSPORTATION & CONSTRUCTION

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THE TRANSIT DEVELOPMENT COMMITTEE  
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## SUMMARY

Staff Report 5c examines the major capital investment options for improving public transportation services in the North Shore sector of the Boston metropolitan region. The report follows the standard PMT corridor format of examining in Section I the regional context of the study area, including demographic characteristics, travel patterns, and a description of the physical characteristics of the separate sub-areas defined for detailed analysis. The Report continues in Section II with an inventory of the regionally significant public transportation services of the corridor. Section III of the reports presents the results of extensive analysis of alternatives under consideration for possible inclusion in the 1976 Revised Program for Mass Transportation.

Section III of the Report describes the process of Alternatives Analysis required by the Federal Urban Mass Transportation Administration for any major capital project to be funded with UMTA capital assistance. Section III reviews the planning process which has been undertaken as part of the North Shore Transportation Improvements Study now being carried out by the MBTA. That process, to this date, has created twelve transportation options for study, and reduced these options to five for intensive further analysis. Section III of this report provides an initial examination of certain characteristics of those five options, and reviews the present policy of the Executive Office of Transportation and Construction towards capital investment in the Corridor. The Staff Report examines the options in terms of the transportation needs of the Lynn area communities in Section IIID, and the needs of the communities to the North in Section IIIE.

This summary will briefly outline the Alternatives Analysis process documented in Section III.

### Derivation of 12 Alternatives

Possible rights of way were examined in combination with potential terminal points ranging from Wonderland in Revere to Gloucester and Newburyport. The report reviews the right of way problems associated with possible rapid transit extensions to terminals at 128 or Beverly, with a discussion of specific problems associated with reconstruction of the present one track B&M railroad tunnel through downtown Salem. Swampscott and North Lynn are examined as possible rapid transit terminal points. The report notes the total-compatibility of commuter rail services with the rights of way in these areas.



From the initial definition of possible service combinations, twelve alternatives are defined as listed below in Table 1.

Table 1  
Capital Costs for the 12 Alternatives

<u>Alternative No.</u>	<u>Estimated Capital Cost</u>
1. No Build	None*
2. Blue Line to Pines River	\$ 33,385,000
3. Blue Line to Lynn	\$ 90,100,000
4. Blue Line to Salem	\$156,400,000
5. Blue Line to Lynn, Terminate Commuter Rail in Lynn	\$ 87,293,000
6. Blue Line to Lynn, Terminate Commuter Rail and all Boston-bound MBTA buses in Lynn	\$ 87,293,000
7. Blue Line to Lynn, Airport Express	\$116,400,000
8. Blue Line to Lynn, Chelsea Bypass	\$127,492,000
9. Orange Line to Lynn, Chelsea Hook	\$150,114,000
10. Upgraded Bus, Minimum Capital Expenditure	\$ 2,630,000
11. LRV to Lynn	\$ 93,100,000
12. Upgraded Rail-No Transit Extension	\$ 68,900,000

\* CRIP II proposed: \$40 million to be spent on 5 commuter rail lines, part allocated to B&M Eastern Route.

#### Comparison of the 12 Options

The staff report presents a comparison of the 12 options in terms of capital costs, operating costs, travel times, and ridership.

Capital costs are shown in Table 1, exclusive of engineering and contingencies. An extension to Salem is shown to be \$66 million more expensive than the extensions to Lynn Center. The possible branch of the Orange line emerges as the most expensive alignment to Lynn. Terminating rail service at Lynn to obtain lower right of way costs near the Pines River saves only 3 million dollars in construction costs. Building an extra track along the existing Blue line alignment is shown to be the least costly express alignment. The CRR figure is not directly comparable, as it includes improvements over a much wider geographic area.

Operating costs for Blue line service every eight minutes during the peak period show a system incremental increase of \$1.3 million per year, compared with an increase of \$5 million a year for comparable Orange line service. The option of truncating CRR at Lynn has no clear operating savings, unless new storage facilities are built in Lynn.



In terms of travel times, the Orange line option is shown to have a one minute travel time advantage over the local Blue line option, but to be five minutes slower than the Blue line express option. The commuter rail system is shown to have the potential to improve its running time to North Station by 8 minutes, cutting present line time from Lynn Center by more than one third. Line haul times are presented between the North Shore communities and the downtown Boston terminals appropriate for each mode.

The Staff Report shows that a Blue line extension to Lynn Center would have from 9 to 10,000 North Shore station boardings per day, with somewhat less than one thousand extra with an express track. The Orange line option would not attract greater ridership from Lynn and beyond, but would divert some 2,800 Chelsea bus riders onto the rapid transit line. The extension beyond Lynn Center to Salem is shown to primarily divert riders from the remaining B&M Eastern Route commuter rail lines, rather than increase absolute patronage significantly. Initial forecasts show the CRR ridership to rise by 35% in the rail-emphasis option, with 15% increase in bus volumes in the bus emphasis option.

#### Narrowing of Alternatives

The Staff Report reviews the decision of the North Shore Transit Improvement Study to carry only five major options into the present, on-going phase of corridor based planning. In the process of narrowing of alternatives, four major options were eliminated from further consideration at this time:

1. Extension of rapid transit beyond Lynn.
2. The construction of a station or terminal at Pines River/Oak Island.
3. Branching the Orange Line to Lynn.
4. Use of LRV's on the Blue Line.

The remaining options were combined and reorganized to create five transportation packages for detailed examination in Phase II of the North Shore corridor study. From these major options must come the refined combination of technologies and services to be included in the Revised Program for Mass Transportation. The major options continued in the North Shore study are:

1. The no-build option (required by law).
2. Extend Blue line to Lynn, with possible express track options.
3. Extend Blue line to Lynn, as above, with all CRR and bus service truncated at Lynn.
4. Upgrade express bus, no Blue line extension.
5. Upgrade commuter rail, no Blue line extension.

## Decisions for Lynn Area Service .

The Staff Report examines the major issues concerning service improvement to Lynn, Nahant, Swampscott and Marblehead. The Executive Office of Transportation has a policy supporting the Blue line as the most effective option to improve public transportation to Lynn Center, with possible incremental improvement through an express track in a second phase of the project.

The report shows that major travel time improvements could be obtained through investment in the two rail modes, with considerably less line-haul improvement possibly through express bus strategies identified so far. At present, the average travel time to downtown Boston destinations (including distribution time) is about 39 minutes from Lynn Center by commuter rail, and 41 minutes bus. The Blue line extension would offer total travel times of approximately 31 minutes from Lynn Center in the local option, with 24 minutes in the express option. The most complete reconstruction option for commuter rail would offer about 32 minute total time; however this option includes an additional transfer for the majority of trip makers, which would discourage ridership and lower the level of convenience experienced by the average rider.

Refined operating costs have not yet been calculated for the final transportation "packages" of the North Shore study. Operating costs will depend on the precise levels of service specified in the final transportation service "packages" examined in the corridor study. The Staff Report examines the operating cost implications of providing service every 8 minutes (peak period) from Lynn Center for 9,000 riders by each of three modes under consideration in the North Shore Study. This brief analysis shows that the cost of providing transportation service is primarily a function of level (of capacity) of service desired, and only secondarily a function of technology chosen. The rapid transit option provides the specified service level at incremental cost about 20% lower than the CRR option, and 33% lower than the all-bus option. Actual refined cost calculations must await the specific service definitions to be defined in the corridor study.

The Report notes that it is the policy of the Commonwealth to provide improved transit services in a manner which will reinforce and augment local community development goals. It is noted that the Blue line extension would focus local/feeder bus services towards Lynn Center, and concentrate accessibility at one point. The two other options, bus and commuter rail are characterized by diverse, parallel line haul services, because neither mode offers sufficiently superior services to merit cut-backs in service by modes. The consolidation of major line haul service at Lynn Center, with consequent feeder service to that point, is seen as a major factor in the revitalization of Lynn.



## Decisions for the Northern Communities

In the North Shore communities of Salem, Beverly and northward, the only major radial transportation options are 1) existing commuter rail, 2) improved commuter rail, and 3) abandonment of rail with replacement bus service. As part of the continuing PMT planning process, the EOTC staff has developed a set of replacement bus services to be compared with the existing commuter rail services of the Eastern Route. Because of a general lack of free flowing radial expressways in the corridor, the bus options tend to have considerably poorer running times than the commuter rail system.

It is shown that most presently served communities would experience a considerable service loss with the bus option. Bus times to Swampscott would be 17 minutes higher than rail times, 18 minutes higher for Salem, and 18 to 24 minutes higher for Beverly. From North Beverly the bus times would be 7 minutes longer than a CRR local, and 13 minutes longer than CRR express.

The operating cost of this replacement bus network was calculated as being \$1.5 million dollars more expensive than the present avoidable cost of the Eastern Route, or .64 million more than total cost of CRR operations. In addition, a net decrease of user travel time benefit would occur valued at \$.46 million.

This brief review of the costs and level of service for a replacement bus system underscores the strong policy commitment of EOTC to retain and improve commuter rail services in the North Shore. Section IIIIE concludes with an analysis of possible major improvements which could be made in the Northern Communities of this corridor, including the option of constructing a multi-modal transportation terminal in Salem.





Staff Report 5c  
Capital Needs Developed at the Corridor Level: North Shore

Contents

	Page
I. Regional Context	1
A. Definition of Study Areas	1
B. Demographic Characteristics	6
C. Travel Patterns	10
II. Inventory of Existing Conditions	13
III. Projects Under PMT Analysis	21
A. Definition of Alternatives	21
B. Comparison of Twelve Alternatives	32
C. Narrowing of Alternatives	43
D. Decisions for Lynn Area Service	48
E. Decisions for Northern Communities	56



## I. Regional Context

### I.A. Definition of Study Sub-Areas

This PMT analysis is organized around the sub-regional grouping of communities established by the North Shore Transit Improvements Study. This section of the Staff Report defines five potentially impacted sub-areas. Part B, below, will examine these areas in terms of demographic characteristics, followed by analysis of travel demand behavior in Part C. Our concern here is the definition of the sub-areas, and the delineation of issues relevant to the PMT analysis.

#### I.A.1. Pines River/Revere Beach Area

The Pines River-Revere Beach area, centering around Wonderland Station, contains the Revere Beach from Beachmont to Pines River, Saugus Marsh and inland from Bell Circle to Cutler Circle. In addition to the Revere Beach and Wonderland entertainment centers are the Wonderland Dog Track and the Suffolk Downs Horse Racing Track. Interspersed within recreational and commercial facilities are residential communities such as Beachmont, Youngs Hill, Oak Island and Point of Pines, retail and industrial land uses.

The principal objective is to coordinate transit and highway improvements with parking, existing land uses, and future development in the Pines River/Revere Beach area.

Through this area pass the major regional transit and auto networks connecting the North Shore to Boston--the Blue line, Commuter Rail, Route 107, Route 1-A, Route I-95, and possibly the planned Revere Beach Connector.

Revere is presently serviced by the Blue line--with three stops, including the Wonderland terminus. This service provides access to East Boston, downtown Boston, and other lines in the MBTA system. There is presently no access to commuter rail from Revere, and the nearest stations are North Station or Lynn for travel to the North Shore. Bus service provides limited access to Malden and Everett, service to East Boston, Chelsea and Boston, and service north to Lynn with limited boarding locations.

Planned proposed developments in the sub-area include the Revere Beach Connector (RBC), which would link Route 1 with a major park-and-ride facility at or near Wonderland Station. There are two optional alignments being considered through the Saugus area by the Department of Public Works and its consultants. Both the alignment of the RBC and location of the parking garage must be coordinated with all

transit options. In addition to the RBC, and closely linked with its construction, is a major residential/retail/commercial development proposed by the Alba Development Corporation. Present plans call for residential, retail, and commercial uses and parking.

Other issues include station location alternatives for a regional transportation center: Wonderland versus Pines River south of the Oak Island neighborhood. A station at Pines River would allow for connection to the Revere Beach Connector as well as allow transfer from commuter rail to Blue Line. However, careful consideration has been given to the effects of such a parking garage and station as the environmentally sensitive Saugus Marsh and the impacts, visual, economic and physical, on residential and recreational uses in the Revere Beach area. This ecological and development factors were critical in the decision to locate the major facility at Wonderland rather than Pines River.

#### I.A.2. Lynn Area

For the purposes of this sub-area analysis, the Lynn area includes Lynn, Nahant, Swampscott, and Marblehead. The objectives of this area include improved accessibility between Lynn and Boston with improved transit feeder connections to Lynn from the surrounding communities. Also, transportation improvements should be coordinated with development proposals for Lynn and other commercial/retail centers in the area.

A study undertaken by Gladstone Associates in 1974 noted that:

"The City of Lynn has experienced a continuing economic decline over the last fifteen years-characterized by an accelerating loss of downtown retail sales; a steady loss of manufacturing jobs; the lowest average household income level of any community in the Lynn "market area"; and an increasingly deteriorating and blighted downtown area, including the Central Business District (CBD), the nearby harbor-front, and the intervening land area between the CBD and the water-front designated by the city's Planning Department as an "Economic Development Area" of approximately 37 acres-and presently occupied primarily by obsolete industrial and warehouse facilities."

Both public and private interest groups, previous to the initiation of the North Shore Transit Improvements Study, had identified a transit extension to the Lynn Central Business District as being a necessary ingredient for attracting new investment and development into the city's downtown area and reversing the present declining trend of retail sales and business activity.





Improvements to vehicular movement are also being considered. An innercity traffic loop is proposed to direct traffic around the central business district to alleviate the congested central streets. In addition, alternatives for a connection between Route 107 and the Lynnway are being evaluated. It is hoped that improved passage between these two major arteries will attract more shoppers to Lynn, particularly those desirous of a smooth access from the Route 1 area.

Because of the central position that a transit stop in central Lynn would have relative to these proposals, close coordination between transit planning (including station location and whether such a station was to serve regional or local demands) and new development is imperative, as well as desirable.

If Lynn were to serve as a regional collector, instead of, or in addition to, Wonderland, location of this intermodel facility in Central Lynn would be difficult due to poor road access and their presently congested condition. A location beyond Lynn center might facilitate access from points north but it would have to be coordinated with road improvements in residential areas or in environmentally sensitive Thompson's Meadow.

### I.A.3. Central Communities

The central communities are comprised of Salem, Peabody, Beverly, Danvers, Lynnfield, and Middleton. These towns are somewhat physically and economically independent of Boston. They do, however, wish to maintain good access to Boston. Present transportation services include bus and commuter rail. There is limited boarding bus service from Salem and Lynn to Haymarket, Boston and limited local bus service between Salem, Beverly, Danvers, and Peabody. One objective is to improve this intertown service and facilitate intermodal transfers.

Any rail rapid transit extension to Salem would have to address two major issues. The first is the potentially negative environmental effect such an extension would have on Thompson's Meadow, an open space in Swampscott of exceptional value. The other issue is whether to locate a station at a point north or south of the single track tunnel running beneath Washington Street and Salem's CBD. This tunnel was constructed in the mid-1950's, creating major disruption while it was built. Since that time Salem has rebuilt and restored its downtown area to a very high standard, equal to that of its major

historic attractions and cultural institutions. There is land available at both ends of this tunnel, and plans have been discussed for developing one or both parcels incorporating new or improved transportation facilities and connecting these facilities to other downtown uses.

A station at the northern end of the tunnel would be in a very accessible location but would necessitate further disruption of Salem's business activity to widen the single track tunnel to two tracks. A station at the southern end would not require tunnel reconstruction but would be out of the center of activity.

Extension of rail rapid transit service to Beverly Center, Route 128, or north would involve the Salem tunnel issue as well as bridge reconstruction over the Danvers River and land takings near Beverly Center. To extend to Route 128, which would be desirable from a highway access viewpoint, numerous grade crossings would have to be eliminated.

Passing through the northern sector of this sub-area is Route 128 with a number of large regional retail centers, office, and light industrial locations. There are presently a number of road improvements being studied by the Department of Public Works, including a Peabody-Salem Connector and upgrading of Route 128 to connect with Route I-95 and improvements to Route 114. All of these should facilitate intertown movements via auto and bus.

#### I.A.4. Northern Communities

The northern communities consist of Topsfield, Wenham, Hamilton, Manchester, Gloucester, Rockport, Essex, Ipswich, Rowley, Newbury, and Newburyport. Of major importance is improvement to commuter accessibility to Boston CBD via rail and bus and evaluation of intertown circulation.

Because of the general lack of frequent transit service, the area is highly auto-oriented. There is a concern that improvements to rail rapid transit would negatively impact present commuter rail and drive increasing numbers of commuters to use their private auto for trips to downtown.

#### I.A.5. Inner Communities

The inner communities include Chelsea, Everett, East Boston, and Winthrop. These four communities share many of the characteristics inherent with close proximity to Boston. They are densely populated urbanized areas, used by many as entryways to the center of Boston.



Of the four communities under consideration, East Boston receives the only direct service by transit. The existing Blue line alignment passes through East Boston, creating noise problems and at some points acting as a physical barrier. Maverick, Airport, Wood Island, and Orient Heights stations serve the East Boston neighborhood.

At present, bus is an important mode of travel for the residents of Chelsea, Winthrop, and Everett. Express service to Boston and inter- and intra-zone service are both in use.

At present Chelsea has neither rail rapid transit nor commuter rail service to Boston, although the B&M Eastern Route passes directly through Chelsea. There are two other sites of high development potential which would benefit from extending transit service to Chelsea. One is the large tract of land that has been cleared as a result of the Chelsea fire; the other is the land and buildings vacated by the Navy Hospital operations. Both of these sites, it should be noted, were isolated in Staff Report #1 as having lower than average accessibility levels.

## I.B. Demographic Characteristics

### I.B.1. Population

Population trends for the Boston Metropolitan Area and the North Shore Study Area are presented in Table 1, based on published data from the Bureau of the Census for 1960 and 1970. As shown, the entire Boston Metropolitan Area experienced an average annual increase in population of approximately 15,800 persons during the 1960's for a growth of 0.6% per year. The North Shore population during the same period grew by nearly 2,400 persons annually, a slightly lesser growth rate of 0.5% per year. The North Shore's share of the metropolitan population thus declined from 18.9% to 18.7% between 1960 and 1970. Stated somewhat differently, during the 1960-1970 decade, the North Shore communities attracted only 15% of the metropolitan area's population gains. The implication is that pressure for new development stemming from population growth on the North Shore was not as strong as in other areas in the metropolitan region, such as the western, southwestern, and South Shore suburbs--which captured larger shares of regional population growth.

It is apparent that population growth during the 1960's was concentrated principally in the central and northern communities, while cities and towns in the inner communities and Revere-Lynn area actually declined in population during the decade. This pattern of a shift away from the inner core



# Tables 1 & 2

## POPULATION FORECASTS NORTH SHORE STUDY AREA 1970-1995

				Average Annual Change			
				1970-1980		1980-1995	
Subareas	1970	1980	1995	Number	Percent	Number	Percent
Chelsea	30,620	26,000	25,000	-462	-1.5%	-67	-0.3%
Everett	42,480	41,000	41,500	-148	-0.3%	33	0.1%
East Boston	35,800	32,500	31,000	-330	-0.9%	-100	-0.3%
Subtotal	108,900	99,500	97,500	-940	-0.9%	-133	-0.1%
Lynn	90,290	89,500	87,400	-79	-0.1%	-140	-0.2%
Revere	43,160	44,500	48,000	134	0.3%	233	0.5%
Saugus	25,110	29,000	34,000	389	1.5%	333	1.1%
Winthrop	20,330	18,400	20,000	-193	-0.9%	106	0.6%
Subtotal	178,890	181,400	189,400	251	0.1%	533	0.3%
Beverly	38,350	45,600	53,000	725	1.9%	493	1.1%
Danvers	26,150	30,500	35,000	435	1.7%	300	1.0%
Lynnfield	10,830	13,200	16,000	237	2.2%	187	1.4%
Marblehead	21,290	21,200	28,400	-9	0.0%	480	2.3%
Nahant	4,120	4,200	5,900	8	0.2%	113	2.7%
Peabody	48,080	54,000	62,000	592	1.2%	533	1.0%
Salem	40,560	41,500	43,000	94	0.2%	100	0.2%
Swampscott	13,580	14,900	16,000	132	1.0%	73	0.5%
Subtotal	202,960	225,100	259,000	2,214	1.1%	2,280	1.0%
Hamilton	6,370	8,500	10,500	213	3.3%	133	1.6%
Manchester	5,150	6,500	8,000	135	2.6%	100	1.5%
Middleton	4,040	5,000	7,800	96	2.4%	186	3.7%
Topsfield	5,200	7,000	9,500	178	3.4%	166	2.4%
Wenham	3,850	4,800	6,200	95	2.5%	93	1.9%
Subtotal	24,630	31,800	42,000	717	2.9%	680	2.1%
Essex	2,670	3,800	5,200	113	4.2%	93	2.5%
Gloucester	27,940	30,000	33,500	206	0.7%	233	0.7%
Ipswich	10,750	13,000	15,400	225	2.1%	160	1.2%
Newbury	3,800	4,000	5,000	20	0.5%	67	1.7%
Newburyport	15,800	16,000	18,000	20	0.1%	133	0.8%
Rockport	5,640	7,000	8,000	136	2.4%	67	0.9%
Rowley	3,040	3,500	4,000	46	1.5%	33	1.0%
Subtotal	69,640	77,300	89,100	766	1.1%	787	1.0%
Study Total	585,020	615,000	677,300	3,008	0.5%	6,220	1.0%

reflects the prevailing trend of suburbanization and urban sprawl which occurred throughout the nation during the 1960's. The projected total 1995 North Shore population of 588,200 represents 18.5% of the projected 3,171,200 population of the total Boston metropolitan area.

Over the long-term future, the distribution of population growth in the North Shore sectors is likely to become slightly more balanced with the inner communities experiencing more redevelopment and in-fill in becoming more stable and the outer communities undergoing slightly lesser levels of growth. However, the major portion of the new gains still are likely to accrue in the central communities (cities and towns in the vicinity of Beverly, Peabody, and Salem) with the other economic sectors experiencing lesser shares of the North Shore population increases. This forecast is illustrated in Table 1, which portrays the 1970, and projected 1980 and 1995 population levels by town as represented by the Central Transportation Planning Staff estimates.

#### I.B.2. Automobile Ownership

One of the prime determinants of transportation modal usage by a household is the availability of the private automobile. Given that all other aspects (out-of-pocket costs, travel time, and so forth) of highway and transit travel are held equal, past studies have shown that transit utilization will decline with increasing auto ownership levels. Table 2 tabulates projected changes between 1965 and 1980 for selected North Shore communities. These data show that auto ownership levels are growing more rapidly than the corresponding population figures, indicating a propensity for increased auto usage and decreased transit utilization within the region. Provision of significantly improved transit service to these towns, over and above that now provided, could be expected to reduce auto ownership levels by a small amount.

#### I.B.3. Employment

Trip making is related to employment activity as well as to population, auto ownership, and the levels of service provided by available transportation modes. For example, generally increasing employment and retail activity within the North Shore region would tend to reduce ties of individual communities with downtown Boston or even with the inner suburbs. On the other hand, location of the increased activity directly on a rapid transit line would assist in attracting transit riders and also may generate increased outbound commuting.

## 1980 Peak Period Trips All Modes All Purpose

Destination	from Inner NS	% of All Trips	% of External Trips	from Outer NS	% of All Trips	% of External Trips
1. Bos Proper	9018	14.9	28.0	6689	4.4	18.0
2. Core w/o Bos Prop	10812	17.9	33.6	7651	5.1	20.5
3. Inner NS	28143	46.6	internal	7578	5.0	20.3
4. Outer NS	5223	8.7	16.2	113297	75.3	internal
5. Inner North	3272	5.4	10.2	3642	2.4	9.8
6. Outer North	1174	1.9	3.6	7727	5.1	20.7
7. Inner NW	718	1.2	2.2	1117	0.7	3.0
8. Outer NW	269	0.4	0.8	938	0.6	2.5
9. Inner West	231	0.4	0.7	167	0.1	0.4
10. Outer West	257	0.4	0.8	391	0.3	1.0
11. Inner SW	218	0.4	0.7	169	0.1	0.5
12. Outer SW	221	0.4	0.7	345	0.2	0.9
13. Inner SS	485	0.8	1.5	406	0.3	1.1
14. Outer SS	298	0.5	0.9	421	0.3	1.1
Totals	60339			150538		



Recent trends in employment levels have been analyzed for the Boston metropolitan and North Shore areas. Employment growth in the Boston metropolitan area for the 1967-1971 and 1972/1973 periods fluctuated considerably from relatively low annual levels between 1967 and 1971 and much higher increases between 1972 and 1973. However, these employment gains may have been eroded during the 1974-75 recession. During this period, the North Shore portion of metropolitan-wide employment has declined from 13% to 12%. Part of this decline may be explained by changes in the definition of covered employment, yet the basic trend is downward. The much smaller share of regional employment (12%) than population (almost 19%) within the North Shore indicates a dependence of the North Shore on downtown Boston and other locations for job opportunities.

Employment trends in each of the four North Shore sub-sectors underline the North Shore's lack of economic growth in the recent past. The inner communities have experienced an actual decline in the number of jobs available from 1967 through 1973. Each of the other three economic sectors has had some fluctuation in its employment changes, and again it is the communities in the Salem/Beverly area which appear to have attracted the major portion of new jobs over this period.

#### I.C.1. Travel Patterns

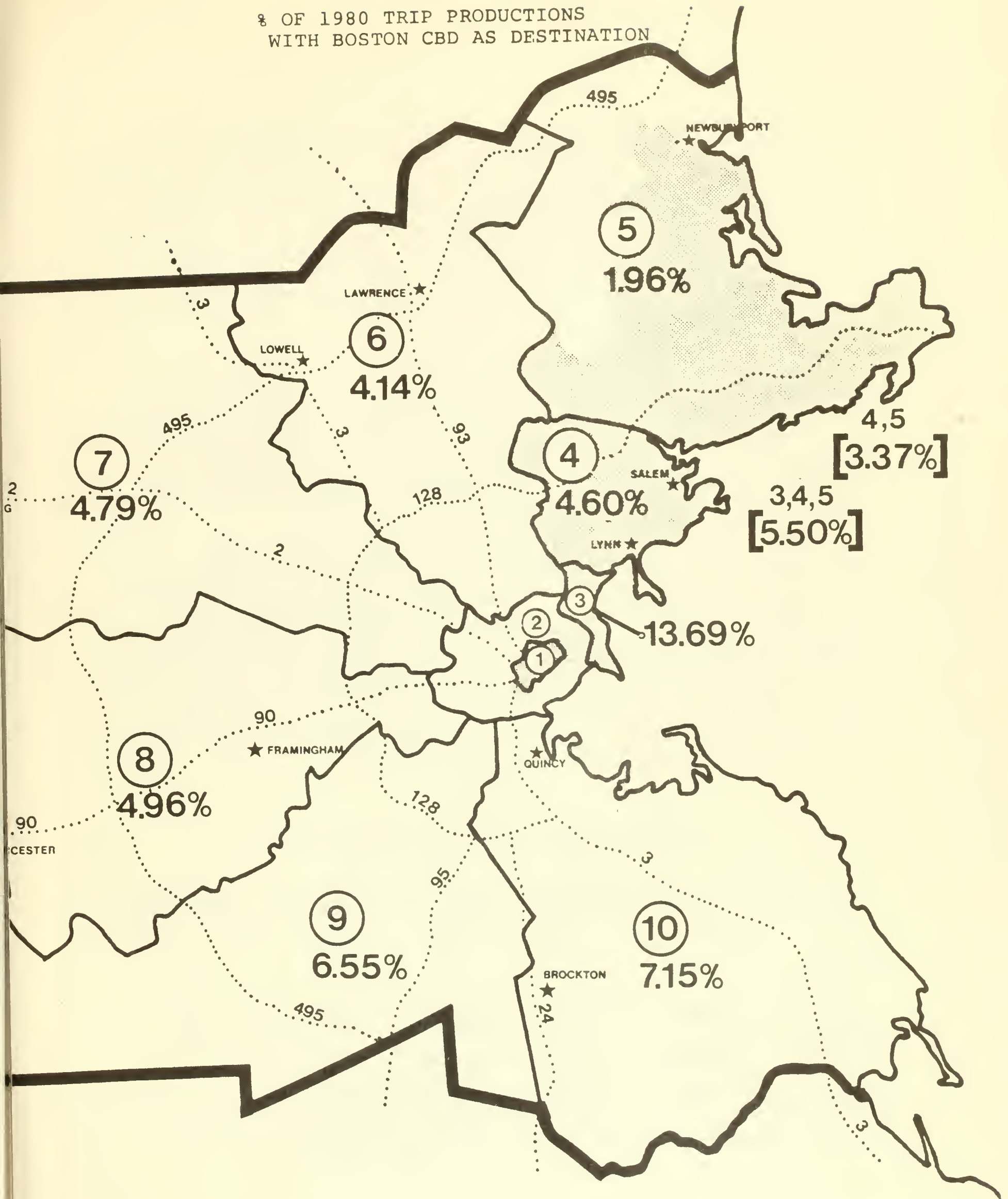
In general, it is anticipated that a Blue line extension would serve primarily trips to and from the Boston Core (that portion of Boston inside Massachusetts Avenue) and within this set, primarily work trips. The prime market area served by a Blue line extension is the central set of communities: Lynn, Saugus, Nahant, Swampscott, Marblehead, Salem, and Peabody. Cities closer to Boston, e.g., Revere, Everett, Winthrop, already are served by rail rapid transit. The northernmost towns, Beverly and beyond, presently are served by the Boston and Maine commuter service. This would continue to be the primary transit mode to Boston, unless the Blue line were to be extended beyond Salem.

The PMT analysis presented in Staff Report 1 (see Table 1 of Staff Report #1) shows that 33 per cent of all morning peak period trips from the inner north shore communities (Winthrop, Revere, Saugus, Lynn and Nahant) are destined for the regional core, compared with 10 per cent of trips originating in outer North Shore communities. This is a smaller core-oriented percentage than for any of the other corridors. Table 3 shows the number of peak period trips from the North Shore to the various subregions.



Figure 2

% OF 1980 TRIP PRODUCTIONS  
WITH BOSTON CBD AS DESTINATION



Analysis of the data for 24-hour trips indicates that only 5.5% of the total North Shore trip productions are Boston core oriented. As shown in Figure 2 , the ties are loosest in the northernmost towns, where only 2% of the trips are Boston oriented. The 24-hour data also shows the relationship between the North Shore and Boston is looser than in any other of the six defined major corridors. The 3.37% of trips to Boston from the central and northern communities compares to 4.96% in the west, 6.55% in the southwest, and 7.75% along the South Shore.

The travel data shows that 39% of the 24-hour trips produced are of an intratown variety, i.e., both the origin and destination are within the same town; another 34% of the daily productions of 1,389,172 are between North Shore communities. The two areas appearing to have the best potential for improved transit circulation service are trips to and from Lynn and travel moving between the towns of Salem, Beverly, Peabody, Danvers, and Marblehead (Table 4 ).

Another potential market for upgraded North Shore transit are reverse commuters--people traveling outward from Boston to various employment and school locations. Analysis of previously collected data demonstrates that reverse commuters may be approximately 10% of the total inbound North Shore trips, depending on transit modes. A survey of users of the new Quincy-Red Line extension showed approximately 6% of the total ridership could be classified as reverse commuters. Logan Airport also constitutes a potential major destination for North Shore based travel, including both work trips and access for the purpose of air travel.

Table 4  
Projected 1980 Intertown Circulation,  
24 Hour Trip Productions

<u>To/From</u>	<u>Salem</u>	<u>Beverly</u>	<u>Danvers</u>	<u>Peabody</u>	<u>Marblehead</u>
Salem	43944	5022	3929	10474	4595
Beverly	8132	47036	8355	5845	906
Danvers	4397	5723	26274	10481	456
Peabody	13233	4132	10337	45602	1043
Marblehead	9311	1356	1016	2023	17187

Source: Central Transportation Planning Staff

## II. North Shore Corridor - Inventory of Existing Conditions

The North Shore Corridor is currently served by MBTA rapid transit, MBTA and private carrier buses, and Boston and Maine commuter rail service subsidized by the MBTA. The MBTA rapid transit Blue line extends from Bowdoin Square, Boston to Wonderland station in Revere. Further extension of the Blue line from Wonderland to Lynn or beyond is now under investigation. In Boston, Blue line passengers can transfer directly to the MBTA Orange line and Green line, but two transfers are needed to go from the Blue line to the Red Line. In 1975 total weekday inbound boardings at the 8 Blue line stations in Revere and East Boston varied from 16,000 to 20,000.

East Boston, Revere and portions of Chelsea, Malden and Winthrop are served by MBTA feeder buses to the Blue line. Feeder buses from Winthrop to the Blue line are also operated by Rapid Transit Inc., a private company subsidized by the MBTA. Five through bus routes from North Shore communities to Haymarket Square, Boston are operated by the MBTA. Route 400-455, Salem to Boston via Loring Ave. serves Salem, Swampscott, and Lynn. Weekday and Saturday service has 30 minute peak and mid-day headways and 60 min. evening headways. Sunday service is hourly all day. Three weekday peak roundtrips on Route 400 operate from Boston to Nahant instead of Salem. Routes 440-441 Marblehead to Boston via Paradise Road and 440-442 Marblehead to Boston via Humphrey St. serve Marblehead, Swampscott and Lynn. Buses on these two routes stop at Wonderland station on the way to and from Boston. Weekday service on both routes is operated on 30 min. peak and 60 min. mid-day headways. Route 400-442 runs on a 60 min. evening headway, but Route 400-441 has no evening service. Both routes run on 60 min. headways on weekends and holidays.

Route 450, Salem to Boston via Highland Ave. and Western Ave., serves Salem and portions of Lynn but by-passes Central Sq. in Lynn. This route has 15 to 20 min. peak, 25 to 60 min. mid-day and 90 min. evening headways on weekdays. Saturday service is on 60 min. headways and Sunday service on 90 min. headways. During weekday peak hours additional trips are operated between Buchanan Bridge and Boston.

Route 426 Lynn to Boston via East Saugus and Cliftondale serves Lynn, Saugus and portions of Revere and Malden. This route has 8-16 min. peak headways, 30-60 min. off-peak headways and 60 min. evening headways on weekdays. Saturday and Sunday service runs on 60 min. headways. During weekday peak periods additional trips operate between Haymarket and West Lynn, between Haymarket and Oaklandvale via Saugus Center, and between Haymarket and Granada Highlands. Route 426 is the only one of the five



TABLE 5

## Headway (minutes)

Approx.

Route Number	Description	Peak	Weekday		Weekend		One way weekday ridership (1975 unless otherwise noted)
			Mid-day	Evening	Sat.	Sun.	
I. Routes through to Boston							
400-455	Salem-Boston via Loring Ave.	30	30	60	30-60	60	450 Salem to Lynn (1971) 1200 at Boston
426	Lynn-Boston via Cliftondale	8-16	30-60	60	60	60	750 at Boston
440	Lynn-Boston via General Edwards Bridge (through Route from 441 and 442)	15	30	60	30	60	750 N. of Wonderland (before consolidation with Rte. 410)
441	Marblehead-Lynn and Boston via Paradise Rd. (Rte. 440 south of Lynn)	30	60	--	60	--	350 East of Central Sq.
442	Marblehead-Lynn and Boston via Humphrey St. (Rte. 440 S. of Lynn)	30	60	60	60	60	400 East of Central Sq.
450	Salem-Boston via Highland and Western Aves.	15-20	25-60	90	60	90	700 at Boston
II. Lynn-Based Local Routes							
410	Cent. Sq.-Winthrop Highlands	60	--	--	--	50-90	475 (before consolidation with Rte. 440)
428	Central Sq.-Oaklandvale (Evenings and weekends to Saugus Ctr)	30	30-60	60	60	120	400 (1971)
429	Central Sq.-N. Saugus	30	30-60	--	60	--	250
431	Central Sq.-Breed Sq.	5-35	--	--	2 trips	--	Not Available
432	Central Sq.-Holyoke St.	30	30	70	30-60	120	450
433	Central Sq.-Pine Hill	30	60	--	60	--	120.
435-487	Central Sq.-Danvers Sq.	60	60	--	60	--	250 (1972)
435	Central Sq.-Lakeshore Park	30-60	60	60	60	120	300 (1969)
436	Central Sq.-Happy Valley	30	45-75	--	60	--	150 (1973)



TABLE 5 (con't)

Route Number	Description	Headway (minutes)					Sun.	One way weekday ridership (1975 unless otherwise noted)
		Peak	Weekday Mid-day	Evening	Sat.			
437	Central Sq.-Lakeside	30	30	70	60		60	300
438	Central Sq.-Highland Circuit	60-70	1 trip	--	--		--	Not Available
439	Central Sq.-Nahant	30-35	40-150	--	60		60	120
444	Cent. Sq.-Forest Ave., Swampscott	15-30	30-150	--	--		--	Not Available
456	Cent. Sq.-Salem via Highland	30	--	--	--		--	
456-1	Cent. Sq.-Buchanan Bridge	30-60	30-180	--	--		--	275 (1971)
456-2	Cent. Sq.-Fay's Ave. & Edgemere	--	60-120	--	60		--	
466	Cent. Sq.-E. Lynn Loop	--	60	--	--		--	60 (complete loop)
467	Cent. Sq.-W. Lynn Loop	--	60	--	--		--	45 (complete loop)

## III. Salem-Based Local Rates

451	Salem-North Beverly	30-40	60	--	60	--	--	175
453	Salem-Salem Willows	50-120	120-135	--	120	--	--	15 (1971)
454	Salem-Marblehead	40-100	120	--	120	--	--	65 (1971)
457	Salem-Tremont and Oakland Sts.	--	120	--	120	--	--	20 (1971)
462-2	Salem-Salem Hospital via Essex St.	--	4 round trips	--	--	--	--	30
463-2	Salem-Salem Hospital via Grove St. Loop	--	3 round trips	--	--	--	--	60 (complete loop)
461-1	Salem-Palmers Cove Loop	--	60	--	--	--	--	60 (complete loop)
468	Salem-Danvers via Liberty Tree Mall east (A.M.) 45 min. P.M.	2 trips	120	--	60-120	--	--	Not Available
463-2	Salem-Danvers Hospital	1 round trip (a.m.)	--	--	2 roundtrips	--	1 roundtrip	Not Available
468-3	Rte. 62 at U.S. Rte. 1 to Salem	2 trips east (A.M.)	--	--	--	--	--	Not Available
468-7	Salem Center-Essex School	1 round trip am; 1 trip 1 round trip pm; west	--	--	--	--	--	Not Available
468-4	Salem Center-Danvers Plaza via Liberty Tree Mall	1 round trip; 1 roundtrip (P.M.)	--	--	--	--	--	Not Available

MBTA Boston-North Shore bus routes to operate for a substantial portion of its length over limited-access highways. South of Linden Square Route 426 runs via the Northeast Expressway and Tobin Bridge. The other North Shore routes follow the Lee-Burbank and McClellan highways and the harbor tunnels. Current schedules and approximate ridership for the MBTA's North Shore to Boston bus routes are summarized in Table 5. Ridership shown in Table 5 is based on MBTA 1975 peak load point counts plus the most recent available complete counts.

In addition to the MBTA five private carriers have through bus routes to Boston from North Shore communities. Hudson Bus lines operates four weekday peak period round trips between North Shore Shopping Center in Peabody and Haymarket Square, Boston via Mass. Rte 128 and U.S. Rte. 1, with flag stops in Lynnfield and Saugus. All except one outbound trip also serve the Boston Greyhound Terminal. One round trip runs through from Windsor Courts in Beverly, also stopping at North Beverly (certain trips serve Peabody Sq. as well as North Shore Shopping Center). Weekend and holiday service is not provided. Boston Commuter Lines, Inc, doing business as Bos-Com has two routes to Boston (Haymarket Square and Greyhound Terminal) from the North Shore, serving primarily communities outside the MBTA district. One route starts in Haverhill and has stops in Georgetown, Boxford and Danvers. Certain trips also stop in Peabody (North Shore Shopping Center) and Topsfield. The other route begins in Amesbury and has stops in Newburyport, Rowley and Topsfield. This route is currently being operated by Kinson Bus Lines of Newburyport under a lease from Bos-Com. Five inbound and six outbound weekday trips are operated on the Haverhill route, mostly during peak hours. Reduced service is operated on weekends and holidays. Three weekday peak period round trips are operated on the Amesbury route, including one inbound trip originating at Newburyport. No weekend or holiday service is operated on this route.

Six daily round trips between Boston and points in New Hampshire and Maine operated by Greyhound Lines carry local passengers between Boston and Newburyport, Topsfield, Danvers, and Lynnfield. One inbound morning trip and one outbound evening trip run during the peak period. An additional evening outbound trip is operated on Fridays, Saturdays and Sundays.

Michaud Bus Lines, Inc. operates three daily off-peak trips from Springvale Maine to the Boston Greyhound Terminal via Routes I-95 and U.S. 1, with stops at Amesbury and Danvers, Mass. Different schedules are operated on weekends and holidays.



In addition to the conventional bus service listed above Hudson Bus Lines operates two limousine routes to Logan Airport serving several Northern and North Shore corridor communities. One route begins in Burlington and includes stops in Stoneham, Wakefield, Peabody, Saugus, and Revere. Weekday headways are 60 min. from 5:45 AM to 9:45 PM. Fewer trips are operated on weekends and holidays.

The other limousine route begins in Haverhill and includes stops in North Andover, Middleton, and Danvers. Weekday service is approximately hourly from 5:00 AM to 9:00 PM. Reduced service is run on weekends and holidays.

Commuter rail service in the North Shore Corridor is operated over two routes by the Boston and Maine Corporation under contract with the MBTA. Service on the Eastern Route Main Line is operated between Boston and Ipswich, a distance of 27.8 miles. There are seven stops on the line, excluding Boston, located in Ipswich, Hamilton, Beverly, Salem, Swampscott, and Lynn. With the exception of Ipswich all of these communities are within the MBTA district. Ipswich is served under a contract between the town and the MBTA. Weekday service consists of 11 roundtrips between Boston and Ipswich, 1 round trip from Boston to Salem, 2 outbound and 1 inbound trips between Boston and Beverly, and 1 inbound trip from Hamilton-Wenham to Boston. There is also 1 late night trip from Beverly to Ipswich connecting at Beverly with a Rockport Branch train. Reduced service is operated on weekends and holidays. Until April 1, 1976 one weekday round trip continued from Ipswich to Newburyport, a distance of 9.5 miles; making no intermediate stops. This train was provided under a contract between the MBTA and the city of Newburyport. It was discontinued because the city government felt that the rapidly increasing subsidy cost could not be justified for the small number of remaining riders.

The Gloucester Branch of the Eastern Route leaves the Main line at Beverly Junction, a distance of 18.7 miles from Boston and runs to Rockport, a distance of 35.3 miles from Boston. There are seven stations on the branch located in Rockport, Gloucester, Manchester, and Beverly. Manchester and Beverly are within the MBTA district. Gloucester and Rockport are outside the district and are served under contracts with the MBTA. Weekday service consists of 12 round trips from Rockport to Boston plus 2 round trips from Rockport to Beverly connecting at Beverly with main line trains. Reduced service is operated on weekends and holidays. Rockport trains running through to Boston also serve Main line stations in Beverly, Salem, Swampscott, and Lynn. Current weekday ridership on the Eastern Route Main Line and Rockport Branch is approximately 2550 one way daily riders. Of these 450 board on the main line north of Beverly, 1400 on the main line south of Beverly, and 700 on the Rockport Branch.



Inter-suburban and intra-suburban bus routes in the North Shore corridor within the MBTA district are operated by the MBTA and by three private carriers. Most of the MBTA's North Shore suburban bus lines originate or terminate either at Central Square in Lynn or at Salem Center. At either of these termini passengers can transfer to MBTA through bus routes to Boston, or to commuter trains on the Boston and Maine Eastern Route. However schedules of many local routes are designed to meet local travel needs and are not well coordinated with either through bus or commuter rail schedules.

All of the MBTA's five through routes from the North Shore to Boston perform local transportation functions as well as line-haul and distribution services. Route 441 and 442, which run through from Lynn to Boston as Route 440 provide local service between Marblehead, Swampscott and Lynn. Since 1975 Route 440 has provided off-peak feeder service between Lynn and Wonderland station on the Blue line. This function had previously been performed by a route of Service Bus Line acquired by the MBTA in 1975. Route 426 from Central Sq. Lynn to Boston via Clifftondale provides local service as Route 426C between Clifftondale Sq. and Central Sq. Route 455, which runs through to Boston as Route 400 provides local service between Salem, Swampscott, and Lynn. Route 450 from Salem to Boston is the only one of the five routes to by-pass Central Square in Lynn, and has less of a local transportation role than the other four.

Excluding the combination local-through routes discussed above there are 15 local MBTA bus routes originating at Central Square in Lynn. Several of these routes have short turnbacks or other variations. Current schedules and approximate ridership for these routes are summarized in Table 5. Nine of the fifteen routes operate entirely within the City of Lynn. Each of the other six routes serves at least one city or town in addition to Lynn. Communities served by these routes include Danvers, Nahant, Revere, Salem, Saugus, Swampscott, and Winthrop. Route 435-487 Lynn to Danvers Sq. passes through Peabody but stops only at North Shore Shopping Center because the city voted in 1970 to have local MBTA service discontinued.

Excluding routes to Lynn and Boston and short turnback routes there are eight MBTA bus routes originating at Salem Center. Five of these routes operate entirely within Salem. The remaining three routes connect Salem with Beverly, Danvers, and Marblehead. Current schedules and approximate ridership for the eight Salem routes (including route variations) are shown in Table 5.

The three private carriers operating local bus routes in North Shore communities within the MBTA district are Lynnfield Community, Inc.; Michaud Bus Lines, Inc.; and Rapid Transit, Inc. Lynnfield Community operates one weekday route from Central Square in Lynn to Wakefield Center. Service is provided between 6:00 a.m. and 6:00 p.m. with 30 to 55 minute A.M. peak headways and 45 minute P.M. peak headways in both directions. Off-peak service is on a 90 min. headway. Ridership for this route is not available for publication. Lynnfield Community is owned by the Hudson Bus Lines interests. Michaud Bus Lines operates three local North Shore bus routes. One route runs from Lakeshore Park on the Lynn-Peabody line to North Shore Shopping Center via Peabody Sq. Weekday headways on this route are 30 min. in the a.m. peak and 60 min. the rest of the day. A second route runs from Salem Center to the North Shore Shopping Center via Peabody Sq. and has 60 min. weekday headways. Both of these routes are made up from portions of routes discontinued by the MBTA in 1970 when Peabody voted to eliminate local MBTA service. The third route is the Castle Hill belt line located entirely within Salem. Weekday service on this route is operated on 60 min. off-peak headways with shorter headways during the peak. The belt line has been operated by the Michaud family for over 50 years.

Rapid Transit, Inc. has been mentioned previously in the discussion of Blue Line feeder routes. This company has been subsidized by the MBTA since 1968 and the MBTA directs the level of service provided. Rapid Transit, Inc. provides service from Point Shirley in Winthrop to Orient Heights Station via Winthrop Beach and Winthrop Highlands. Weekday headways are 12 min. in the peak period and 24 minutes in the off-peak. Approximately 2500 one-way weekday riders use this route.





### III. PROJECTS UNDER PMT ANALYSIS

#### III A. Definition of Alternative

##### III A. 1. Background

The Revised Program for Mass Transportation must resolve certain capital investment decisions in the North Shore corridor which have been under debate for several decades. The legislature's recess commission on metropolitan transit recommended in 1945 that the East Boston transit line, which then terminated at Maverick, be extended to Lynn via an abandoned narrow-gauge railroad right of way. The line was extended as far as Wonderland by 1954.

The 1966 Program for Mass Transportation did not include a further extension of the rapid transit line in its list of immediate "Action Projects." Instead, the PMT indicated that further study was required on that project. In 1969, the final report of the Eastern Massachusetts Regional Planning Project (EMRPP), recommended that the extension of the Blue Line (as it had been designated by then) to Lynn and beyond be included for implementation in the "long range" program, while a Phase I extension to the Pines River should be planned for earlier implementation.

The Boston Transportation Planning Review (BTPR) investigated Blue Line issues in connection with its examination of the proposed construction of Interstate 95 and a Revere Beach Connector through the inner North Shore communities. The BTPR conclusions were that an extended Blue Line should not replace commuter rail service, nor should commuter rail service be terminated a new Blue Line Station.

The 1974 Transit Development Program (TDP) included an extension of the Blue Line to Lynn in its list of projects recommended for implementation in the first five years, as did the 1975 revision of the TDP. Both of these documents recognized that further refinement of this project was necessary, including determination of terminal and alignment.

The Blue Line extension is now receiving a new emphasis. This emphasis is due largely to Governor Dukakis' stated policy of encouraging the beneficial redevelopment of older urban areas, such as Lynn. The Blue Line is seen as one element of the city's plans to revitalize the downtown Lynn area, as well as providing substantially improved transportation service to residents of the inner North Shore communities.

In 1975, the MBTA began a comprehensive study of transportation needs in the North Shore corridor, with an examination of alternative transit improvements to help meet those needs. The Phase I Feasibility Report for the North Shore Transit Improvements Project (NSTIP) details the analysis of some twelve alternative transit improvements.

### III A. 2. Derivation of 12 Alternatives

The PMT is primarily concerned with those capital investment decisions which are regional in nature. These investment decisions concern mode, alignment, terminal points, and service level. In the North Shore planning process, these elements were examined in the creation of 12 program packages for detailed evaluation. Staff Report 5c now reviews those alignment and terminal options that were examined and rejected in the creation of the 12 options for further study.

The study examined several alternative rapid transit terminal and alignment options before creating the twelve alternatives. No significant options for CRR or busway alignment alternatives were found.

The range of possible rapid transit terminations geographically extend from the present terminus at Wonderland to the end of the B&M Eastern Route Mainline to Newburyport and/or the Gloucester branch to Rockport. However, there are several possible end-of-the-line station locations between these two extremes. The possible termini initially considered are the no-build or upgrade at Wonderland, "Pines River" (the Oak Island area of Revere), Lynn, Central Square, Swampscott/North Lynn, Salem commuter rail station area, Salem bus terminal area, Beverly, Route 128/North Beverly, and out to the ends of the Gloucester and Newburyport branches. The B&M Eastern Route right-of-way is the only alignment under consideration for all options extending past Oak Island.

The options lying north of the Salem Tunnel are considered together, since they all include the possibility of widening the tunnel through Salem. The present one-track tunnel under Salem Center was constructed in 1957, and in order to accommodate rapid transit, the tunnel would have to be widened to two tracks. If commuter rail is retained and/or it is impossible to schedule rail freight service at night, at least three and possibly four tracks would be required. This construction would involve high capital costs, with estimates ranging from 20-25 million dollars. The impacts of construction to Salem would be considerable. This is a negative consideration for all extensions north of the present Salem station.



Ipswich and Gloucester. The farthest possibility is that of extending the transit line along the B&M Eastern route either on the Eastern Route Mainline or Gloucester Branch to Hamilton and/or Ipswich or Gloucester. Such extensions must span low-density rural areas to reach the towns, and when ridership projections are compared to the capital and operating costs involved, the cost effectiveness of such an extension becomes very low. These lower density areas can better be served by modes other than rapid transit and for this reason, this extension was not pursued in further detail.

Rte. 128. The next terminus considered was an extension to a station at Route 128, relocating the present North Beverly station southward to the point where the Gloucester Branch joins the Eastern Route Mainline. This site has the potential of attracting auto users to transit by furnishing a park and ride facility. Under this option commuter rail would be terminated from the north at the North Beverly Station and from the east at the Beverly Station. This is necessary due to right-of-way width restrictions through Beverly and the high costs, both in terms of dollars and economic disruption, of widening to a 3 or 4 track right-of-way. The result of this option would be the forced transfer from commuter rail to transit at Beverly and the movement of all freight at night. These negative implications led to the dropping of this alternative from further consideration.

Beverly. The closest station location south of Route 128 included as an alternative was the present Beverly commuter rail station. An extension into Beverly or beyond would require a new bridge spanning the Danvers river. If commuter rail and/or freight service is to be operated concurrently, the bridge must be widened to 3 or 4 track widths.

Widening the tunnel through Salem and locating the rapid transit station about a half mile north of the present commuter rail station location was also viewed as infeasible. The site of the present bus terminal was mentioned as a good location for the rapid transit station since this would permit the advantage of a station serving all three modes--bus, rapid transit, and commuter rail. This location would provide reasonably good access to Salem Center. However, this does not compensate for the cost and negative impacts associated with the tunnel widening. Thus, because of the difficulties and unfavorable conditions presented by the Salem Tunnel, the Danvers River Bridge, right-of-way restrictions in Beverly, the desire for retention of commuter rail service and rail freight, and low population densities in the B&M Eastern Route corridor, terminations north of the present Salem commuter rail station were deemed infeasible for further investigation in this study.



Swampscott. South of the present Salem station, the only termination point that was not carried over for detailed study in Phase I was the Swampscott-North Lynn Area.

Three options exist for termination of transit in the Swampscott-North Lynn area. The northernmost of these is in an area known as Thompson's Meadows in Salem. This is the area of the Task C feeder road system which is proposed to link Route 107 with the Swampscott-Marblehead region. Included in the proposed system is an extension of Swampscott Road across the B&M tracks to an intersection with Loring Avenue. The establishment of a station adjacent to the rail-highway crossing is of course dependent upon the approval and construction of the Task C project.

It is probable that the development of a station at Thompson's Meadows would introduce serious environmental problems. While it is likely the proposed arterial improvements will have relatively little adverse impact, a transit terminal would require development of land on a much greater scale. Much of this development would be in the form of parking facilities for the park-and-ride patrons; the isolated nature of the area would preclude any walk-in patronage. There is also the possibility that development induced by the presence of a transit station could cause further environmental damage. For these reasons, and the cost of protective measures, the Thompson's Meadows termination was discarded.

Another possible station location is the present site of the B&M commuter rail stop in Swampscott. Such a location would attract some walk-in patronage but, in order to be cost-effective, would require a sizable volume of patrons arriving by the local street system. The additional automobile and bus traffic generated would tax the capacity of collector and distributor streets, though the proposed Task C improvements and TOPICS-type programs could relieve this congestion. If commuter rail and transit are to serve the North Shore concurrently, this option will require some acquisition of right-of-way. The four-track right-of-way in Lynn narrows to three tracks in Swampscott and would require widening over a distance of 2,000 feet.

A third option for termination is in North Lynn, specifically the area of the B&M crossing of Eastern Avenue. The high-density residential nature of this area would discourage construction of a major park-and-ride terminal, but a smaller neighborhood transit station is possible. The feasibility of this option depends on the volume of ridership anticipated with the small terminal.

Alignments. Six possible alignment options for termination at Lynn, were examined. One of these was the extension of the existing Blue line on the Boston, Revere Beach and Lynn narrow gauge right-of-way from Wonderland, through the Point of Pines, across the Saugus River connecting with the B&M Eastern Route Main Line in West Lynn. This option was discarded because of the environmental impact on closely bordering communities. Due to the proximity of housing, it would be necessary to construct noise barriers along one or both sides of the right-of-way, and even this measure would not ensure a sufficient reduction in noise.

The other possible alignment that was not retained for further study in Phase I was the utilization of the B&M Saugus Branch for an extension of the Orange line. The Orange line would be branched at a point north of the Wellington station, cross the Malden River, and join with the Saugus branch. One option would utilize the entire northern portion of the Saugus branch to its junction with the B&M Eastern Route in Lynn, continuing to Central Square. A second option would leave the Saugus branch near Cutler Circle, cross the Pines River, and continue along the I-95 embankment through the Saugus Marsh. It would then cross the Saugus River, rejoin the Saugus Branch to the Eastern Route junction, and continue into Lynn.

Preliminary investigation revealed that many structures would have to be reconstructed or built in order to eliminate the many grade crossings presently existing, and the cost of the alternative would be much larger than any of the others, and was not retained for that reason.

The alignments thought to be most feasible and that were studied in more detail in Phase I are the following:

- (1) Extension of the existing Blue line to a junction with the B&M Eastern Route to continue to Lynn on the B&M right-of-way.
- (2) A second alignment option is to branch the Blue line at the Airport station.
- (3) A third alignment option, the "Chelsea Bypass", also branches the Blue line at the airport station. The purpose of this alignment is to extend transit service to the residents of Chelsea, in addition to serving the North Shore.
- (4) Chelsea Hook is the fourth alignment alternative. This alternative is to extend a branch of the Orange line from Sullivan Square along the B&M Eastern Route into Lynn, with stations in Chelsea.



### III.A.3. Description of the 12 Alternatives

#### 1.) No-Build

The "No Build" alternative retains the existing transit, rail and bus systems and provides a base with which other alternatives can be compared. The existing system is described in the previous section of this Staff Report.

Committed improvements on the rapid transit include the proposed purchase of 70 new #4 East Boston cars. Since the present rolling stock is in poor condition, this purchase will result in some upgrading of service on the Blue line.

Phase II of the Commuter Rail Improvement Program (CRIP), is anticipated to be approved by the Federal Government early in 1976. The CRIP includes rail and tie replacement, grade crossing eliminations and track realignment and will produce higher operating speeds on many sections of the route. However, trains will still be required to reduce speeds on most of the bridges.

There are several highway improvements in the North Shore that are in various stages of design, public hearings or environmental impact assessment. Only one, the Revere Beach Connector, has been assumed to be a "committed" project and would affect public transit service. These facilities are included in the no-build assumption.

#### 2.) Blue Line/Pines River

In this alternative, the Blue line would be extended past Wonderland to Pines River, in the area immediately south of Oak Island. Presently undeveloped, this site would be provided with good access from Routes 1A and 107 by the proposed Revere Beach Connector, and will include parking facilities for 2000 cars. The two rail rapid transit tracks are completely grade separated from local streets and from the commuter rail tracks.

Blue line service and technology on this one-station extension would be similar to that of present operation from Bowdoin to Wonderland. Headways will remain at approximately 3.5 minutes during peak, and 7 minutes offpeak, and the acquisition of new cars for the existing Blue line will proceed as planned.

The new station would be built adjacent to the B&M tracks, and the commuter rail would be scheduled to stop at Pines River. The joint rapid transit-commuter rail station would be designed to accommodate across-platform transfer between modes.



Other than this new stop, commuter rail operations will continue to operate in a similar fashion as today.

The existing MDTA North Shore to Haymarket Station bus routes would feed into the Pines River station and terminate there, forcing Boston-bound passengers to transfer modes. The 450 Salem-Boston route, via Western Avenue, would bypass the station and continue to travel directly to Boston.

### 3.) Blue Line/Lynn

This alternative assumes the extension of the Blue line from Wonderland to the Central Square-Market Street area of downtown Lynn. The alignment of this extension through Revere could follow two possible routes to join the B&M right-of-way, and then proceeds to Lynn along side of the commuter rail tracks. If a Pines River Station is included in this alternative, a major park-and-ride facility (2000 car garage) would be built there. If not, the Revere Beach Connector would be designed to serve an expanded Wonderland Station and an adjacent Parking garage.

Commuter rail service would be retained to Boston North Station. No direct MBTA bus service would remain between Lynn and Boston, with the exception of the Salem-Boston run, which is not routed through Central Square. All other buses, currently bound to Boston, would terminate at the station in Central Square. This station would accommodate transfer to other buses, commuter rail, and rapid transit, and perhaps provide parking spaces nearby for commuters. Some rerouting of bus lines would occur in order to maintain service to areas in Lynn adversely affected by these changes, and to Point of Pines, Revere.

### 4.) Blue Line/Salem

The Blue line terminal point in this alternative is Salem. This station would be located at the south portal of the one-track tunnel through Salem, which is several blocks south of the town center. This station would be a transfer point between commuter rail and rapid transit.

The alignment from Wonderland to Lynn would be the same as described in Alternative 3. From Lynn to Salem, the rapid transit would share the same right-of-way as the B&M Eastern Route. Stations would be located at Lynn and Salem, and perhaps at either Pines River or in Swampscott near the current B&M Swampscott Station. Every other rapid transit train would be scheduled to terminate at Salem resulting in peak headways of about 8 minutes and off-peak at 15.

#### 5.) Blue Line/Lynn/Truncate Rail

Alternative 5 has the same rapid transit characteristics as alternative 3--the Blue line is extended to Lynn, at low service frequency (8 minutes peak and 15 minutes offpeak headways). Boston-bound buses are terminated at the Central Square station except for the Salem-Boston run, and the Lynn-Boston via Clifftondale.

However, the commuter rail will not continue to Boston's North Station, but is terminated at Lynn Central Square. Thus, commuter rail passengers destined to Boston (from the North Shore) are forced to transfer to rapid transit at Lynn. Since the daily maintenance is now conducted in the Somerville yards, a new maintenance facility would have to be located north of Lynn, perhaps in the Salem freight yards. Additional trackage would be required in Lynn for temporary storage and switching of cars.

#### 6.) Blue Line/Lynn/Truncate Rail and Bus

Alternative 6 incorporates all the same rapid transit and rail characteristics in Alternate 5--including commuter rail termination in Lynn, but the Salem-Boston bus would be dropped. Thus, only rapid transit would provide direct service to Boston from Lynn, and all MBTA bus patrons and commuter rail passengers would be forced to transfer to rapid transit.

#### 7.) Blue Line/Lynn/Airport Express

The Blue line rapid transit is extended to Lynn in this alternative, and includes the addition of an express track(s) between the Airport Blue Line station and either Wonderland or Pines River.

There are several possible alignment combinations for the express tracks and the connection between Wonderland and the B&M right-of-way near Oak Island. One alternative is an additional track in the existing MBTA right-of-way. Alternatively, single or double express tracks could be extended from Airport to either Wonderland or Pines River in the Penn Central and B&M East Boston rights-of-way.

Trains running express from Bowdoin would make local stops until Airport, and then switch onto the express tracks to Wonderland or Pines River. From there, trains would continue to and from Lynn on the double track.

Headways of 8 minutes during peak and 15 minutes during offpeak would be set for Lynn cars, and service on the local branch would be maintained at 4 minutes during peak and 8 minutes offpeak. The frequency of service at the stations served by both trains would be increased still further.

### 3.) Blue Line/Chelsea "By-Pass"

The alternative, the "Chelsea Bypass", includes a branch off of the existing Blue line at the Airport Station. From Airport, the tracks are routed under Route 1A, then on to the Penn Central-Boston & Albany right-of-way to the Chelsea River. A bridge, constructed over the river and above Eastern Avenue, would permit grade-separated operation. The tracks then would continue at grade to the B&M Eastern Route right-of-way adjacent to which a Chelsea station would be located. The rapid transit line would consist of two tracks, following the B&M Eastern Route to Lynn. A multimodal station could be located at Pines River, or the transit could continue without another station until Lynn. A Wonderland-Pines River connection between the two lines is not included in this option.

Rapid transit service on the Chelsea branch would be set at 8 minutes peak and 15 minutes offpeak. On the mainline, service would at least remain at 4 minutes peak, 8 offpeak. Commuter rail service would remain through to North Station. Bus service would be revised to take account of the rapid transit expansion into Chelsea, and service to Boston via Route 111 Woodlawn would be rerouted to and severed at the Chelsea Station. The only bus routes from Lynn to Boston in continued operation would be the 450 Salem and the 426 Clifftondale.

### 9.) Orange Line/"Chelsea Hook"

The Orange line extension to Lynn branches off of the existing Orange line near Sullivan Square, and continues in the B&M Eastern Route right-of-way to Lynn. The two-track line would feature station stops in Chelsea, at a site slightly west of the Northeast Expressway, perhaps Pines River, and Lynn. Orange line headways on the Lynn to Forest Hills branch would be set at 8 minutes peak, and 12 minutes offpeak. This Orange line connection to the CBD would provide direct service to Washington Street and State Street, and transfers to the Red and Blue and Green lines.

Although this service would parallel the B&M commuter rail service for almost all of the journey between North Station and Lynn, the commuter rail service was assumed to continue operation into North Station, at the same level of service currently provided. The bus service would be changed in a



fashion much as in Alternative 8. Since Chelsea would be served by rapid transit, some bus routes would be redirected to the station, and some would be terminated. Again, since Lynn would be supplied with rapid transit service, only the indirect route to Boston, the 426 Cliftondale, and the Salem to Boston via Western Avenue service would be retained.

#### 10.) Upgrade Bus

This alternative provides for the upgrading of the current North Shore to Boston bus service in order to improve the present levels of service. This low-capital expenditure alternative proposes to "upgrade" bus service by decreasing travel time and providing more frequent service to Boston. No provision is made for any rapid transit extension, or changes in commuter rail service.

To improve bus travel times to Boston, one of the two lanes on the Charlestown exit ramp of the Mystic River Bridge would be designated as bus only, separated from auto traffic automatic lane delineators. From the Charlestown off-ramp to City Square, the buses would travel in a contra-flow bus lane down a one-way street to City Square, where special bus priority signalization would speed the buses through that intersection to the North Washington Street and travel the four blocks to the Haymarket busway. All MBTA North Shore to Boston buses would be able to take advantage of this improvement, as well as the Revere Woodlawn bus, and the private carriers that travel on Route 1.

Marblehead and Swampscott commuters also would benefit by express service from Marblehead-Vinnin Square direct to Haymarket via Lynn Shore Drive and the Lynnway. Only limited stops would be made, and the bus would bypass Central Square. Salem commuters would have connecting service at Vinnin Square, and Nahant commuters could transfer to the service at Lynn Shore Drive.

The Salem-Boston 450 route would be improved by instituting a "Salem Limited" service which would not stop to pick up or discharge passengers between Eastern Avenue, Lynn and Haymarket, thus speeding up the bus journey.

#### 11.) Light Rail Vehicles

This is the only alternative technology option, featuring light rail vehicles (LRV's) for the extension to Lynn.

This alternative incorporates most of the characteristics of alternative 3A. The light rail vehicles which would have to be modified from those ordered for the Green Line, would be substituted for the Blue line cars, operated from Bowdoin to Lynn. Between Wonderland and Lynn, the LRV's would run in the B&M right-of-way, with station stops at Pines River, West Lynn (Commercial Street), and Central Square. Commuter rail operations would remain unchanged, and only the 450 Salem and 426 Cliftondale buses would continue to operate between Lynn and Boston.

## 12.) Upgrade Commuter Rail

This alternative assumes that the rapid transit and commuter bus operations will be unchanged from today's service, but the commuter rail system will be modified to provide better travel times. The terminal points, route alignment, and vehicle technology for commuter rail will remain as is today, but reconstruction of the track and railbed will permit train operation at 60 mph.

Since the existing CETA/EDA rail improvements will upgrade much of the track between the Mystic River and Beverly, this alternative would have to reconstruct not only approximately 25% of the trackage on that segment, but all of the track between Beverly and Rockport, and Beverly and Newburyport. New rail bridges would be constructed over the Charles, Mystic (Draw 7), Pines, Saugus, and Danvers Rivers, and improvements to the existing Annisquam River Bridge in Gloucester, in order to permit near constant speeds. Additionally, nearly 70 other rail or highway bridges would receive reconstruction to various extents, and an upgraded signal system would be installed.

Over and above the rehabilitation of 84 Budd cars proposed under the CRIP program (approximately 21 of these are used on the Ipswich and Gloucester Routes), this alternative includes the purchase of 16 additional passenger coaches and four locomotives.

### III.B. Comparison of the 12 Alternatives

The twelve alternatives created for study in the NSTIS were examined in terms of their capital costs, operating costs, travel time characteristics and ridership. A summary of these comparative costs and service levels is included at this point in the Staff Report. This data, plus initial environmental and community oriented analysis was used to drop several options, and propose five options for further analysis in the coming phase of the North Shore study. This section reviews the principal conclusions of this narrowing of alternatives process. Section IIIC, below, then examines the remaining option in the context of immediate decisions for the Program for Mass Transportation.

#### III.B.1. Comparative Capital Costs

Comparative capital costs were estimated for each of the twelve alternatives and are presented in Table 6 , below. Each of the alternatives includes estimates for right-of-way acquisition costs, construction costs of embankment and structures, grade separation, construction of track, electrification and communication equipment, construction of stations and station access roads, and purchase of adequate rolling stock. Not included in any of the estimates are costs for engineering, support services, or contingencies. The costs are comparative only and have been developed from very preliminary engineering designs and alignments.

80% of the capital cost of any new project will be funded by the Federal Government, upon submission and approval of a capital grant application. The remaining 20% of the capital investment must be borne by local citizens. The local share of costs was figured on an annual basis, including annual operating cost and repayment of interest and principal on the construction costs.

The no-build (Alternative No. 1) includes little or no investment, and the upgraded bus alternative (Alternative No.10) represents the minimum investment plan. The Pines River Blue line extension is the minimum investment extension of rapid transit. Significantly, the Orange line option has the highest cost. The table shows that the existing Blue line R-O-W is the least expensive express option. Salem service has a high \$66 million incremental cost over the Lynn options.

#### III.B.2. Operating Costs

The methodology used in estimating operating costs attempted to arrive at the variable costs associated with improvements



of service of the existing modes. Fixed costs, such as office and clerical expenses, shop and power plant equipment, and buildings and ground, were isolated and eliminated from operating costs in order to provide an index to the incremental expense associated with each of the twelve alternatives. Included in the variable cost was cost of equipment, power, structures and right-of-way costs, conducting costs and all labor costs associated with each category. An additional 11% of the total labor cost was included to account for pensions and gratuities.

Table 6  
Capital Costs for the 12 Alternatives

<u>Alternative No.</u>	<u>Estimated Capital Costs</u>
1. No Build	None*
2. Blue Line to Pines River	\$ 33,385,000
3. Blue Line to Lynn	\$ 90,100,000
4. Blue Line to Salem	\$156,400,000
5. Blue Line to Lynn, Terminate Commuter Rail in Lynn	\$ 87,293,000
6. Blue Line to Lynn, Terminate Commuter Rail and all Boston-bound MBTA buses in Lynn	\$ 87,293,000
7. Blue Line to Lynn, Airport Express	\$116,400,000
8. Blue Line to Lynn, Chelsea Bypass	\$127,492,000
9. Orange Line to Lynn, Chelsea Hook	\$150,114,000
10. Upgraded Bus, Minimum Capital Expenditure	\$ 2,630,000
11. LRV to Lynn	\$ 93,100,000
12. Upgraded Rail-No Transit Extension	\$ 68,900,000

\* CRIP II proposed: \$40 million to be spent on 5 commuter rail lines, part allocated to B&M Eastern Route.

The unit operating cost was thus calculated for each of the modes. The Blue line operating cost was estimated at \$2.69 per car revenue mile, for the Orange line at \$2.67, \$3.00 for commuter rail per car revenue mile, and \$2.06 for bus per vehicle revenue mile. These costs are similar to the detailed cost calculations formulas used in the PMT analysis. These costs will be revised in the next phase of PMT planning.

The annual revenue mileages were then projected for each of the alternatives and used to predict the increase in variable operating cost incurred by the proposed improvement. The estimated annual operating costs are calculated in terms of 1974 dollars. Table 7 displays the annual operating costs by mode. Alternative 1, the "No Build" alternative, is the base case and the incremental costs of the other alternatives can be estimated by comparison to this alternative.

Table 7  
Annual Transit Operating Costs

<u>Alternative</u>	<u>Rail Rapid</u>	<u>Commuter Rail</u>	<u>Bus</u>	<u>Total</u>
1	11,750,000	4,384,000	8,167,000	24,301,000
2	12,611,000	4,384,000	7,410,000	24,405,000
3	14,171,000	4,384,000	7,065,000	25,620,000
3a	15,251,000	4,384,000	7,151,000	26,786,000
4	16,962,000	4,384,000	6,788,000	28,134,000
5	14,171,000	3,298,000	7,151,000	24,620,000
6	14,171,000	3,298,000	6,788,000	24,257,000
7Double Track	17,126,000	4,384,000	7,151,000	28,661,000
Single Track	15,499,000	4,384,000	7,065,000	26,948,000
8	17,298,000	4,384,000	6,489,000	28,171,000
9	18,443,000	4,384,000	6,489,000	29,316,000
10	11,750,000	4,384,000	8,526,000	24,660,000
11	15,251,000	4,384,000	7,151,000	26,786,000
12	11,750,000	4,384,000	8,167,000	24,301,000

Table 8

## Annual Revenue and Operating Ratio

<u>Alternative</u>	<u>Annual Revenue and Operating Ratio</u>			<u>Commuter Rail Operating Revenue</u>
	<u>Annual Rail Rapid Revenue</u>	<u>Rail Rapid Operating Ratio</u>	<u>Annual Commuter Rail Revenue</u>	
1	3,090,000	0.263	1,282,000	0.293
2	4,790,000	0.363	1,588,000	0.362
3	5,438,000	0.346	997,000	0.227
3a	5,681,600	0.338	997,000	0.227
4	5,975,700	0.304	612,000	0.139
5	5,470,000	0.349	916,000	0.378
6	5,470,000	0.349	1,100,000	0.334
7 Double Track	5,690,000	0.296	997,000	0.227
Single Track	5,690,000	0.325	997,000	0.227
8	5,930,000	0.304	997,000	0.227
9	6,722,700	0.320	997,000	0.227
10	3,090,000	0.263	1,246,000	0.284
11	5,700,000	0.338	997,000	0.227
12	3,090,000	0.263	1,518,000	0.273



Approximate calculations of revenues were made for each of the alternatives, for the rapid rail transit and commuter rail modes. The revenue figures are presented in Table 8 together with operating ratios which represent the fraction of annual cost covered by revenues. Generally, operating deficits are paid by the communities, though some Federal operating subsidies may be available. The percentage of deficit borne by the individual communities would be calculated according to the MBTA assessment procedures.

Operating costs for the rapid transit mode increase in all but Alternatives 1, 10, and 12. In many cases, these increases are largely offset by decreased commuter rail and/or bus costs. The savings accrued by discontinuation of commuter rail service south of Lynn in Alternatives 5 and 6 are significant but would be lower if maintenance operations were to remain in Boston. Any Blue line extension to Lynn, Pines River or Salem would result in redundant and costly service if bus service to Boston was maintained. So the 400, 440, 441, 442 were terminated in Lynn or Pines River and the 450 was terminated in several alternatives. However, local service was retained at similar frequencies on those streets that were supplied with service by the Boston Routes.

### III.B.3. Travel Times

Each of the twelve alternatives contains a certain combination of rapid transit, commuter rail, and bus service, and each transit mode has a trip time composed of access-from-origin time, waiting time, travel time, transfer time, and access-to-destination time. Table 9 summarizes the overall travel time for the 12 alternatives. For most alternatives, noticeable changes in travel times compared to today will occur mainly in the middle communities in the study area. The inner communities from Revere south will still be served with frequent service by either Blue line rapid transit or local bus service to Wonderland, Maverick, Sullivan Square, or Haymarket Square; the outer communities (from Beverly northward), now served primarily by commuter rail service, would not be affected by most of the rapid transit variations.

Many of the persons from the middle communities travelling to Boston on public transportation are presently routed through downtown Lynn. Therefore, the only part of their trip time which would change on all of the transit-extension-to-Lynn options is from Lynn to Boston. Alternatives 3 and 11 would have little change from today's travel times, since the time required to transfer from local buses to the transit line is about equal to the time saved by taking the rapid transit from Lynn to Boston instead of the present "express" buses.

	Existing	Alts. 2, 3, 4, 11	Alts. 5, 6	Alt. 7	Alt. 8	Alt. 9	Alt. 10	Alt. 12 RR
	BL Bus RR	BL Bus RR	BL Bus RR	BL	BL	OL	BL Bus	RR
State Street	16	14 17 22 30	14 17 22	11 16	13 18 26	16 21 28	14 27 46	15 24 58 55
Haymarket								
North Station								
Wonderland								
West Lynn								
Lynn								
Salem								
Rockport								
Newburyport								

Not included are access, wait, or transfer times.

BL = Blue Line  
RR = Commuter Rail  
OL = Orange Line

By halving the transit headway, however, in Alt. 3A, the decreased waiting time for the next rapid transit car would save enough time to make this option faster than today's travel times. The Blue line to Salem, Alternative 4, would save a significant amount of time for a downtown Salem to downtown Boston trip; although some of this advantage would be lost during access to the rapid transit system, there would still be an overall travel time saving for many persons.

Alternatives 7 and 8, by virtue of their shorter route distances and fewer stops, offer the fastest rapid transit time from the Lynn area to Boston. Number 9, via Chelsea and the Orange line, includes more stations than 7 or 8, but is still faster than Alt. 3A or 4 in overall time. Travel by commuter rail, Alt. 12, is nearly identical to the fastest rapid transit alternative (No. 7) to the Lynn area, and provides this service to a far greater area than the Blue line extension proposals would serve. The commuter rail does terminate at North Station, however, which results in a longer total trip time for a person to reach his final destination because of poorer connections to the downtown distribution system at this portal. Access to the MBTA rapid transit system at North Station is nearly identical to that at Haymarket Square, though, so those persons who do transfer to the subway will not lose any time relative to express bus users. In fact, if bus service can be instituted to provide coordinated access to North Shore train stations under this option, an excellent overall transportation system would be established.

Upgraded bus service, Alternative 10, would provide mixed results for travel times. On one hand the proposed service would be faster than most comparable auto trips would be in 1980 and would provide a "one-seat ride" (i.e. no change of vehicles to reach downtown Boston), but on the other, the bus travel alternative would not be as speedy as most of the rapid transit variations.

Alternatives 2, 5, and 6 are estimated to actually increase total trip time for many passengers, thereby having a net negative impact on travel times. Alt. 1 which serves as the base of comparison for other alternatives assumes some improvements to travel times under the proposed Commuter Rail Improvement Program, Phase II, and from certain highway projects, which are separate projects from the NSTIPS. Alternative 2 creates a forced transfer at Pines River for most Boston-bound buses, and the time lost in this transfer would make this bus-to-transit trip longer than the present direct bus to Boston. Similarly, Alternatives 5 and 6, which



terminate both bus and railroad service in Lynn, would result in a small net loss in travel times relative to the other alternates because of the mandatory transfer. These times would still be faster than today's trips, however.

#### III.B.4. Ridership

Transit ridership and auto trips for the twelve alternatives were estimated using binary choice travel demand models (auto/transit) developed by the Central Transportation Planning Staff and by Cambridge Systematics, Inc. Three broad categories of trip purpose were considered--home-based work trips, home-based trips for purposes other than work, and trips that have neither their destination nor their origin at home.

As a means of both simplifying and expediting the ridership forecasts during the Phase I feasibility analysis, forecasts of Blue line commuter rail and express bus trips focused on trips between the North Shore and the Boston CBD since the market analysis indicated this would be the primary type of trip served by various forms of Blue line extensions. These estimated "corridor" trips were then expanded based on available data to allow for transit trips to other parts of the Boston region, e.g. Cambridge and Brookline; Logan Airport; reverse or outbound trips, e.g. General Electric, Salem State Teachers College; and trips from outside the region using North Shore transit facilities. One entrance portal to the core was defined for each of the transit modes--Blue line, Orange line, Commuter Rail and Express Bus--and downtown distribution times and costs calculated from this point.

Table 11 disaggregates the rapid transit turnstile count into two parts: the turnstile count on the existing segment and the turnstile count on the new segment, where one exists. This information was used in generating revenue projections associated with an extension and also in determining operating equipment requirements.

Comparative Analysis. The following paragraphs briefly analyze the Tables 10 and 11 turnstile count results in terms of the four basic dimensions of choice: termination point, alignment, technology and service.

With respect to termination point, the data shows that any extension will attract new Blue line riders; a large number of these though were former express bus riders whose service is assumed to be terminated. Extension to Salem

provides for a 37% increase in Blue line usage (18% total transit) compared to 28% for equivalent service to Lynn (14% total transit) and 19% for Pines River (12% overall). The major ridership cost of an extension to Salem is 52% loss in post-CRIP commuter rail usage.

Regarding the four basic alignment choices, the airport express (18%) and the two Chelsea locations (20% and 30%) emerge as significantly superior to the Wonderland extension (14%) again based on equivalent frequency of service. This is due to the slower travel time and greater number of stops associated with usage of the existing Blue Line. The Orange Line loop through Chelsea has the highest ridership increase because of the particular area of Chelsea served by this alignment and the superior downtown distribution service provided by the Orange line compared to the Blue line. The 47% increase in subway turnstile count, however, includes a diversion of 2800 riders from the present Chelsea bus routes #111 (considered to be a non-line haul service and not included in the turnstile counts for the other alternatives). Excluding these diverted bus trips yields a 35% increase instead of the recorded 47%. Due to the location of the Chelsea station of the Blue line Bypass, this alternative attracts 700 users of the bus #111, considerably less than the Orange line station location.

The light rail vehicle option was analyzed as a variation of Blue line service to determine the benefits of this potentially more flexible technology. From a ridership perspective the additional stations provided with LRV results in a 4% increase in transit turnstile counts, the same as the airport express service. In all other respects, the LRV alternative is equivalent to Alternative 3A.

Modal Competition. All alternatives involving some form of transit extension assume termination of all current express bus service to Boston operating through Lynn. This amounts to approximately 73% of current express bus riders. Further, it is projected that extension of rapid transit service to Lynn will result in a loss of 633 riders or 22% of the post-CRIP B&M Eastern branch patronage. This loss becomes at least 52% if the system is further extended to Salem. Alternative 6 (terminate all commuter rail and express bus operations at Lynn) converts the commuter rail into a rapid transit feeder or collection service, and actually results in less of a decline as defined. In summary, commuter rail and rapid transit are involved in an inevitable competition for riders especially from the Central and Route 1 oriented communities which are the primary areas served by a rapid transit extension to Lynn. Any extension of either the Blue or Orange lines beyond Pines River will attract at least some of its riders from the commuter rail system.

# SUMMARY OF DEMAND ANALYSIS TABLE 10

ALTERNATIVE Name	#	24 Hr. North Shore Turnstile Counts				
		Total Volume	Δ	Subway Volume	Railroad Volume	Express Bus Volume Δ
Base (1975)		25600	--	20600 <sup>a</sup>	2500 <sup>b</sup>	2500 <sup>c</sup> --
Existing w/ CRR Improv.	1	25950	+ 1%	20600	2850	+14% --
BL to Lynn Low Freq.	2a	29210	+14%	26324	2217	-11% 669 -73%
BL to Lynn High Freq.	2a	30037	+17%	27151	2217	-11% 669 -73%
Airport Express	2b	30127	+18%	27241	2217	-11% 669 -73%
Chelsea Express	2c	30609	+20%	27723	2217	-11% 669 -73%
Chelsea Loop	2d	33160	+30%	30274	2217	-11% 669 -73%
BL to Lynn Term. RR & bus	3a	29582	+16%	26492 <sup>d</sup>	2445	- 2% 645 -74%
Upgrade Exp. Bus	4	26254	+ 3%	20600	2770	+11% 2884 +15%
Upgrade Rail	5	26046	+ 3%	20600	3375	+35% 2371 - 5%

a/ from MBTA one-way weekday turnstile count, Dec. 4, 1974.

b/ from B&M partonage data, 1975.

c/ derived from numerous ridership reports, 1974-1975.

d/ does not include transfers from railroad and/or express bus.



Table 11  
Rapid Transit Turnstile Counts Inside/Beyond Wonderland

<u>Alternative</u>		<u>24 Hour North Shore Rapid Transit Turnstile Counts</u>	
<u>Name</u>	#	<u>Maverick-Wonderland</u>	<u>Beyond Wonderland</u>
		<u>Volume</u>	<u>Volume</u>
CRIP	1	20600	--
BL to Pines R.	2	16961	7491
BL to Lynn, Low	3	16426	9898
BL to Lynn, High	3A	16425	10726
BL to Salem	4	16426	11706
BL to Lynn, term. RR	5	16426	10066 <sup>a</sup>
BL to Lynn, term. RR & bus	6	16426	10066 <sup>a</sup>
Airport Express	7	16542	10699
Chelsea Bypass	8	15915	11808
Chelsea Loop <sup>b</sup>	9	15710	14564
Upgrade Exp. Bus	10	20600	--
LRV	11	16426	10784
Upgrade Rail	12	20600	--

<sup>a</sup>Does not include transfers from railroad and/or bus; including these figures, the "beyond Wonderland" counts would be 13,093 and 13,156 respectively.

<sup>b</sup>New segment constitutes extension of the Orange Line.

The above discussion is in terms of total line haul volumes. Table 11 separates the projected turnstile count into a Maverick-Wonderland segment and a beyond Wonderland segment. Assuming a transit base of 20,600, this table indicates that approximately 4000 of those now boarding either at or inbound from Wonderland will shift to a station on the rapid transit extension. The remaining volume boarding on the extension would come from existing auto, commuter rail, and express bus users. Of the alternatives examined, maximum Blue line ridership occurs when all commuter rail and express bus service is terminated at the end of the Blue line. If the termination point is at Lynn, a 24 hour daily count of over 13,100 would be obtained. If commuter rail and non-Lynn based express bus service is continued, then the estimated "beyond Wonderland" count is approximately 10,000 or 40% of the total boardings beyond Maverick.

### III.C. Narrowing of Alternatives

#### III.C.2. Issues Resolved in "Phase One"

The Program for Mass Transportation will recommend a specific package of transportation improvements for the North Shore corridor. At present time, the North Shore Transit Improvements study has narrowed down the options to five possible programs, some of which combine certain characteristics of several of the original 12 into new program package options. The recommendation of one final program, however has not yet occurred at the corridor level. The "Phase Two" analysis is expected to take two to three more months. It is highly probable, that a consensus can be reached to include certain projects directly in the PMT, with other projects to be better defined in later phases of implementation.

The conclusion of Phase I does considerably clarify real PMT options for the North Shore, however. Specifically, 4 decisions have been made as a result of the NSTIS. These issues, and their resolution, are summarized in this section of the Staff Report. Consensus has been reached to curtail further policy attention on the following four options: 1) Rapid transit beyond Lynn; 2) A Pines River station or terminal; 3) an Orange line branch; 4) light rail vehicles on the Blue line.

1. Extension of Rapid Transit beyond Lynn. The efficiency of extending rapid transit to Salem or beyond was specifically examined in Phase I of the North Shore study. After consideration of the various impacts of such an extension, it was concluded that such an extension would not be consistent with the transportation and development goals of the outer North Shore communities. Instead commuter rail should provide for the major line-haul needs of these communities.

Travel time to Boston from Salem and beyond would be little better by rapid transit than is currently offered by commuter rail or bus service. While the proposed Salem rapid transit station would attract a substantial number of riders, this gain in ridership would come almost exclusively at the expense of the commuter rail ridership. That is, there is almost no increase in total public transportation ridership expected from a rapid transit extension to Salem, since it offers little improvement in travel time.

Commuter rail was found to provide service in the moderate transit demand area beyond Salem more effectively than either bus or rapid transit. The reduction in commuter rail ridership

resulting from a rapid transit extension to Salem would decrease the viability of the commuter rail service and may require a reduction in service on that line.

An extension of rapid transit beyond Salem would further aggravate the commuter rail problem. In addition, a new tunnel under Salem Center and a new bridge over the Danvers River, which would be required for a rapid transit extension, would require a substantial capital investment, and would result in severe construction-period disruption in Salem.

The extension of rapid transit to Salem would require a capital cost of \$66 million dollars more than an extension to Lynn, and would involve an additional \$2.5 million dollars per year in operating cost over the Lynn extension.

As a result of these findings, the option of extending transit beyond Lynn was not carried into the Phase II analysis. The transportation needs of the communities beyond the Lynn area are discussed below in Section III E of this Staff Report.

2. Pines River Station. The construction of a rapid transit station in the Saugus Marsh near the Pines River has been proposed in conjunction with the proposed construction of the Revere Beach connector between Cutler Circle on Route 1 and the Revere Beach Parkway. The Pines River Station was included in each of the rapid transit extension options investigated in Phase I. In these options, the Pines River Station would provide a 2000-car parking facility connected to the Revere Beach connector, and would also provide for transfers from feeder bus and commuter rail.

Because of the large amount of fill required for construction of the station at this site, the flood-holding capacity of the Saugus Marsh would be reduced, creating an increased flood hazard for the areas bordering the marsh. Further, the transit station would conflict with the use of this area for recreation and as a nature preserve.

The Pines River station would add little to the potential for well-planned development of the Revere Beach area. The station would be too far from the beach to significantly improve access to the recreational areas there. The Wonderland station (existing or relocated) provides a superior opportunity for coordinating transportation facilities with development plans. This station is located close to the beachfront and the proposed development areas. In addition, the Wonderland station could also serve as a major transfer facility, with access from the Revere Beach Connector, and land is available for parking.



The Pines River station, either as a terminal or an intermediate station on a rapid transit extension, was dropped from consideration after the Phase I analysis.

3. The Orange Line "Hook" through Chelsea. Chelsea is highly transit-dependent community due to its density, income level, and low auto ownership. At present, there is no rapid transit station in Chelsea. Instead, Chelsea residents must take a bus to Blue line stations in East Boston or directly to Haymarket Square in Boston. The proposed extension of rapid transit to Lynn is seen as a possible opportunity to provide rapid transit in Chelsea.

Two of the alternatives under analysis in Phase I could provide a station in Chelsea. One of these, the extension of the Orange line from Sullivan Square through Chelsea, was found to have severe cost and service problems, and this option was not carried to Phase II.

The Orange line hook, with a single station in Chelsea, would cost \$60 million dollars more than the Blue line extension to Lynn. Further, because of the additional length which would be operated, it would require an additional \$3.2 million dollars a year in operating cost.

Significantly, the Orange line extension would provide only a one-minute improvement in travel time from Lynn stations, compared to a simple extension of the Blue line from Lynn. When compared to the Blue line option with an express track, the Orange line requires five minutes more travel time to downtown Boston from Lynn stations.

Further, the construction of a second Orange line branch from Sullivan would provide an imbalance in demand between the northern and southern sections of the Orange line, during the peak hour, leading to less-than-efficient operation.

The Orange line "hook" through Chelsea was dropped from consideration after Phase I, although the option remains of constructing a Chelsea station on a Blue line extension from Airport to Lynn.

4. Use of Light Rail Vehicle on the Blue Line. The use of LRV's on the proposed extension of the Blue line was proposed for several reasons: the low-platform and on-board fare collection capability of the LRV makes this vehicle ideal for moderate-volume, multi-stop service which might be provided in Lynn; it would provide an increased standardization of the MBTA fleets, since the Blue line cars are due to be replaced anyway; and it would allow the future linking of the Blue line from the North with the Green line from the west, elimination of a downtown transfer for some riders.

However, the modal transfer provisions proposed at Lynn Center, as well as the East Boston stations produce high volumes which are better served by the high-platform vehicles currently in use on the Blue line. Major reconstruction of power, stations and tunnels would be necessary to make the Blue line compatible with the LRV. Further, the LRV's would have to be modified to clear the tunnel sides. The modifications to the vehicle and to the tunnel, power and platforms are extensive enough that the LRV does not appear to be a suitable alternative.

### III.C.2. Issues for PMT Resolution

The Phase I study of the North Shore Transit Improvements Project narrowed the twelve original alternatives into five alternatives by rejecting some options and combining others. The five alternatives which are being carried to Phase II for further analysis include:

- 1) The no-build option which must be carried through the final analysis, by federal regulation.
- 2) An extension of the Blue line to Lynn. This option combines the various express track options, as well as the simple extension of two Blue line tracks from Wonderland. With this alternative, two stations would be located in Lynn, one in West Lynn and one in or near Lynn Center. If the Chelsea bypass suboption is elected, a station would also be located in Chelsea.
- 3) An extension of the Blue Line to Lynn, with commuter rail and bus service truncated at Lynn Center. This is the same as (2) except that all rail and bus patrons would be required to transfer to the Blue line in Lynn Center.
- 4) Upgrade bus, no rapid transit extension.
- 5) Upgrade commuter rail, no rapid transit extension. This upgrading would rebuild the commuter rail line to allow 60 mph operating speeds. It should not be confused with the CRIP program, which will refurbish the existing line without substantial changes to grade crossings, etc.

In terms of major facility options there are three elements to be resolved and combined into the Revised PMT: The Blue line extension, a commuter rail alternative and an express bus alternative. The corridor planning undertaken so far strongly indicates that different technologies are most appropriate in different sub-areas of the corridor. Thus, Section IIID and IIIE of this Staff Report examine the transportation needs of the area around Lynn, and the communities further north, in separate discussions.

The five options carried into Phase II of the corridor study imply two sets of capital investment options, one for the Lynn sub-corridor, and one for the communities to the North. For the Lynn area, the major facility question is whether to provide improved service with the Blue line, with express bus, or with improved commuter rail. These options are discussed in Section IIID below. For Salem, Beverly and Northward, the essential decision is between existing commuter rail, improved commuter rail, and express bus. These options are discussed in Section IIIE of this Staff Report.



### III-D Decisions for Lynn Area Service

#### III.D.1. Status of Planning

The North Shore study will examine all five transportation options in its coming "Phase II" effort. For the Lynn area, the study will examine improved service with Blue line, re-constructed commuter rail and express bus. Subject to further refinement at the level of detailed Environmental Impact Analysis, the Executive Office of Transportation and Construction has a policy which favors the extension of the Blue line to Lynn Center in an initial phase, with the possibility of constructing an express track as a second phase of the project. This policy direction is based on the results of a participatory process over the past 3 years which has emphasized the importance of taking state transportation actions which serve to re-enforce the viability of older urban centers by tying them firmly into the public transportation system of their own corridor, and strengthen the connectivity to other regional economic activities.

The section reviews the remaining alternatives in terms of the need to improve the accessibility of the Lynn area to the other communities of the corridor, and to the important regional core.

#### III.D.2. Travel Time Characteristics, for Lynn Service

The major alternatives to Lynn Center are marked more by their similarity of travel time characteristics than by their difference. The PMT planning process has included a detailed examination of the travel times from Lynn to all downtown destinations. This detailed analysis is necessary to allow comparative examination of transportation alternatives which have different downtown terminal locations.

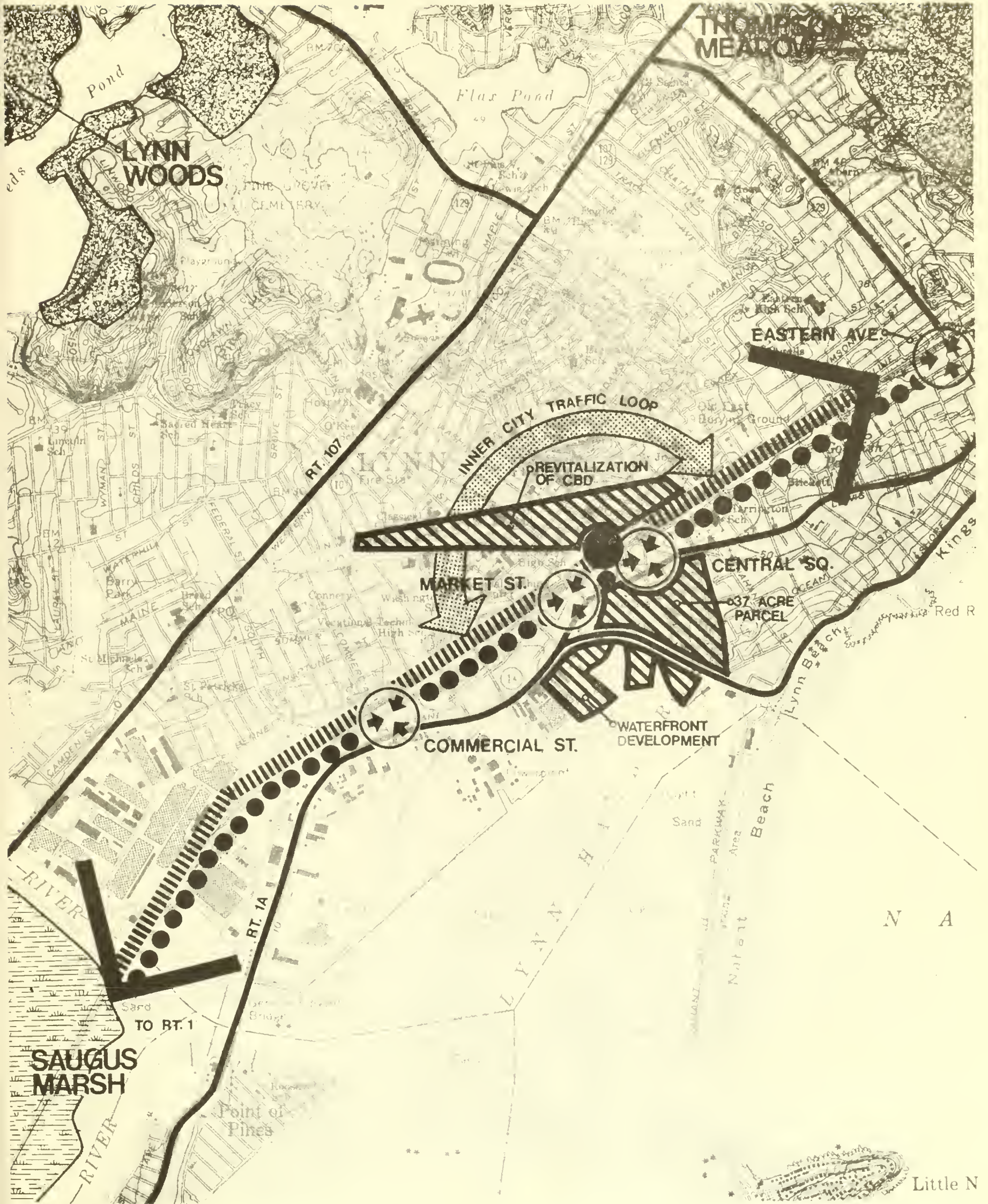
In this analysis travel times were computed which included in-vehicle travel times, transfer times, and walk-from-station times to all CBD destinations. From these calculations comes a weighted average travel time from Lynn Center to downtown Boston from each alternative. Waiting times at Lynn are not included, and are presumed equal for the purposes of this analysis.

Base and Bus. The weighted average Lynn Center to downtown at present is 38.6 minutes via commuter rail, and 42 via express bus. The options under study show that considerable improvements in these times are possible with several options. The available data for the express bus option shows a travel time improvement of only two minutes from the bus-preference schemes



SUB AREA 2  
LYNN AREA TERMINUS

FIGURE 3





examined so far in the North Shore. Unless significantly greater line haul time savings can be obtained for the improved bus alternative, it must be concluded that the express bus alternative is the least attractive of the remaining options in terms of travel times from Lynn Center.

Blue Line Options. The potential travel time savings with several Blue line options and several commuter rail investment options are considerably greater than the bus improvements analyzed so far. Specifically, the Blue line local option would cut average Lynn-Boston travel time to 31.2 minutes, a savings of 7 or 11 minutes over the two existing services. A Blue line express track would provide the lowest total travel time to all CBD destinations, with an average trip time of 23.6 minutes, more than a 15 minute improvement over the present conditions.

CRR Options. There are several levels of possible improvement to the commuter rail running times between Lynn Center and Boston. At present, the in-vehicle travel time is 23 minutes, with average total time of 38.6. This poor running time is a direct result of right-of-way conditions between Lynn and North Station. Historically, running times of 18 minutes were commonly operated, with speed restrictions in effect over the Pines River Bridge at Oak Island. The North Shore study calculated that with reconstruction of the Pines River crossing, reconstruction of the crossing of the Mystic River and new structural and track throughout, a travel time of 15 minutes is theoretically obtainable. However, because of uncertainty concerning merging activity at Reading Jct., a 16 minute travel time has been used in PMT analysis as the best CRR running time.

The resulting total travel time savings are significant improvements. The 18 minute line time would cause a total trip time of 33.6 to downtown destinations. With speed restrictions lifted on reconstructed bridges, the 16 minute line time would allow a 31.6 min. total trip time.

Comparison of the Blue line and CRR travel times reveals the basic trade-off which exists between modes which offer faster line speed, and modes which offer better downtown distribution. The express characteristics of the CRR have much faster line speeds between Lynn Center and North Station. However, the State Street alignment of the Blue line penetrates the highly developed financial district, delivering patrons directly to major destinations without long walking distances, thus creating total travel times directly comparable with the reconstructed CRR option. In addition, the local Blue line investment can be incrementally improved



in a later phase with an express track which lowers total travel time to 23.6 minutes, 8 minutes faster than the best commuter rail reconstruction option.

### III.D.3. Operating Cost Comparisons, for Lynn Service

The final "package" of transportation improvements to be recommended by the North Shore Study will most likely include a mix of several modes providing separate, but complementary service. Commuter rail schedules will be designed to meet the needs of the finally defined service area. This section of Staff Report 5c, presents the results of a different kind of operating cost analysis. This section examines the cost of providing a fixed level of service for the Lynn area market by three separate options, commuter rail, express bus, and rapid transit.

It has been a principle theme that the cost of providing transit service is primarily a function of trip length and level of service specified, rather than a function of technology characteristics. Thus, this section compares the operating cost of carrying 9,000 riders from the Lynn area to Boston with service at least every 7.5 to 8 minutes on the three possible modes for Lynn service.

Rapid Transit. The cost of operating additional service on the Blue line for the Lynn extension has been calculated in the North Shore study as \$2.4 million per year (1974 unit costs), for service which operates north of Wonderland every 8 minutes in the peak period, and every 15 minutes in the off-peak. (Local service is assumed, with total travel time characteristics approximately equal to the CRR option described in the previous section.)

Commuter Rail. The EOTC staff created a CRR schedule which would provide shuttle service between Lynn Center and North Station with service every 7.5 minutes, coordinated with other Eastern route services, and consistent with Reading service needs through the Reading Jct. shared track area. Off peak service for Lynn was provided every 15 minutes, consistent with the assumptions set for this analysis. The incremental cost of providing this Lynn shuttle service was calculated as ranging from \$2.9 million to \$3.1 million per year in commuter rail operating costs (1974 unit costs). (Any possible increase in cost to distribute these 9,000 people from North Station has not been calculated.)

The Lynn shuttle schedule, proposed peak period schedules for service North of Lynn would be adjusted to provide uniform

headways of 15 minutes each through Lynn. A shuttle operating every 15 minutes leaving from Lynn was assumed in the analysis. Costs were calculated both for the new shuttle service, and for the increased capacity added to the other trains to provide additional Lynn capacity.

Express Bus. To handle the capacity assumed for this analysis, express buses would have to operate every 1 minute in the peak hour every 2-3 minutes in the rest of the peak period. Twelve minute headways would be operated during the off-peak. The buses would operate over the alignment of present Route 440, with preferential treatment wherever possible. The total cost of this Lynn to Boston intensive bus option would be \$3.7 million (1974 unit costs).

Comparison of Options. The cost of providing direct service from Boston to Lynn approximately every 8 minutes in the peak, and approximately every 15 minutes in the off-peak with capacity to carry 9,000 riders per day has been calculated for three major technology options. The strategy of operating every other train beyond Wonderland emerges as the lowest cost option to provide a given level of service to a given number of passengers. The cost of providing Lynn-Boston service by bus is about 50% more expensive, while the intensive CRR Lynn shuttle would cost about 25% more than the transit costs attributable to Lynn service.

In terms of the capital cost of vehicles, the rapid transit option would require about 30 additional cars, for approximately \$15 million of capital costs. The commuter rail shuttle would require 40 RDC cars costing between \$20 and \$25 million due to the additional Lynn shuttle service. The hypothetical bus service would require approximately 80 buses, costing about \$5 million dollars.

This analysis reveals the range of operating cost differences attributable to technology and alignment characteristics, with both capacity and service level assumption held constant. The detailed proposals to be produced in the North Shore Study will include operating cost calculations based on specific schedules designed to accommodate ridership actually forecast for each mode. Thus final headways and capacity assumptions will vary between modes when the final networks ("packages") are defined. It has been the purpose of this analysis to demonstrate the operating cost differences of the three technology options with service assumptions held constant.



#### III.D.4. Ridership

Refined ridership forecasts suitable for detailed environmental analysis will be prepared for Phase II of the North Shore study. The presently available ridership data has been presented in Section III.B.4 of this Staff Report. Briefly stated, the 1980 ridership differences between the major alternatives are not major. Logically enough, the Blue line express options show the greatest increase in transit trips occurring between the North Shore and downtown Boston, with the other three options having largely similar ridership characteristics, which parallels their similar overall trip time characteristics.

The extended Blue line would service some 9 to 10,000 station boarders at the two proposed Lynn stations. A significant number of North Shore riders who now use various feeder modes to get to the present Blue line would now get more direct Blue line service with the Lynn extension. While the absolute number of transit riders to Boston would be quantitatively similar in the three major options, the Blue line option would give an increased level of service to the greatest number of people. In both the express bus and improved CRR options, there are still several thousand people who minimize their travel times by routing themselves through the not-extended Blue line. These are inner North Shore riders with downtown destinations along State Street, either to Government Center or to the financial district. Thus, while the Blue line extension would directly benefit 9-10,000 riders, the other options would carry less than half this number. Table shows this data from Phase One of the North Shore Study.

More significant differences between the remaining alternatives involve trips to non-downtown destinations. Both the bus, which operates "closed-door" over the expressway system, and the commuter rail option which operates express to North Station, have less ability to serve intra-corridor trips. Table 3 in Section I.C.1. of this Staff Report shows the strength of travel within this corridor. Thus, the ridership data presented in Section III.B.4. shows the Blue line option with several thousand more transit trips (all transit modes) than either the express bus or the commuter rail option, attributable directly to intra-corridor trips in both directions.

The next iteration of transit forecasts (for the limited number of options now under consideration) will more explicitly consider trips to Logan Airport and other major trip attractions along the Blue line corridor. The importance of these intra-corridor trips will be addressed in quantitative terms with the addition of this data.



The importance of this connectivity within the inner North Shore corridor is demonstrated by the preliminary calculations of overall user benefit caused by the Blue line extension. Of the approximately 500,000 hours of passenger travel time savings, over half were revealed to be trips within the North Shore corridor.

#### III.D.5. Development Impacts

At this time, the corridor based planning study is examining in detail the development impacts of the build and no build options on the City of Lynn. The firm of Gladstone Associates is currently working with the Lynn Planning Department to define strategies for maximum coordination of transportation and land development implementation. This PMT report will not dwell in detail on this important on-going work effort. Rather, certain observations can be made from the regional perspective appropriate for the PMT.

In terms of development impacts, there are in essence only two scenarios for Lynn--major concentration of transportation accessibility around a major inter-modal transfer point, or, continued reliance on diverse transportation services collecting riders in different ways. This is an important differentiation to make when examining development strategies for downtown Lynn.

As noted in the previous section, the two no-build alternatives would divert additional riders to either express bus or commuter rail services. However, travel from the study area would continue to be characterized by a reliance on three modes of service from one area. Many riders would continue to route themselves via the non-extended Blue line to minimize their travel times to destinations near State Street and the financial district. Because the CRR option imposes an additional transfer on these riders, not all bus service would be re-organized into feeder service for this line haul service. The Blue line extension would cause a major restructuring of feeder service to Lynn Center, and allow the replacement of the parallel express bus service, to support the 9-10,000 projected station boardings at the two Lynn stations. Its impact would be to focus accessibility, rather than to disperse it.

The potential for increasing development opportunities in the Lynn area is expected as an important impact of the extension of rapid transit to Lynn. With proper local controls, this development can be a beneficial contribution to the local and state goals of redeveloping the older urban areas of Lynn.

It should be cautioned that the rapid transit facilities alone will not result in a massive infusion of development dollars, but it can be an important element in channeling regional employment and economic growth into the areas around stations.

The role which the Blue line extension might play in channeling development can be explained in several ways. First, the large number of people which would board rapid transit at Lynn Center creates a market for services and goods which would be supplied by local businesses. This concentration of persons in one market area (Lynn Center) in an important economic impact of the Blue line extension that is not provided by the bus-to-Boston option, since the bus spreads pickups and drop-offs over a larger area. Likewise, the commuter rail fails to draw a large number of persons to Lynn Center.

Second, the improved access to Boston destinations will help make the Lynn area an attractive place to live for people who work in Boston. This can be expected to have an impact on housing construction and rehabilitation in the Lynn area. Third, the extension of the Blue line will make Lynn more accessible to people who live in Boston, East Boston, and Revere. An employer who would locate in the Lynn area, then, can attract employees from these areas who, through need or preference, commute by public transportation. Further, businesses in Lynn may find a need to provide fewer parking facilities for their employees and customers. The improved bus and upgraded commuter rail options do not provide a convenient service for reverse commuters, and thus would not provide this benefit.

The extension of rapid transit to Lynn is one element in the city's plans to revitalize Lynn Center. While other efforts will be necessary for the full fruition of these redevelopment plans, the effect of the extension should not be minimized.

### III.E. Decisions for the Northern Communities

#### I.E.1. Alternatives to Commuter Rail Service in the North Shore Corridor

In 1968 the Massachusetts General Court directed the MBTA to prepare at least three alternative programs for suburban commuter service in the areas then served by subsidized rail routes. As a result the firm of Simpson and Curtin, Transportation Engineers, Philadelphia, was engaged by the MBTA to develop a plan for an express bus system to replace commuter rail operations. The Simpson & Curtin plan, published in January 1969 was used as the starting point for EOTC analysis of bus alternatives to commuter rail.

The Simpson & Curtin plan did not include service to any communities served by subsidized rail but located outside of the MBTA district. By law the MBTA can only provide services outside its district if they are run at a net profit or if net losses are reimbursed by the state or by the communities served. Marginal costs of commuter rail service operated outside the district do not, therefore, affect the deficit. Given the economics of MBTA operations rail replacement services outside the district would be unlikely to be self-sustaining and would therefore be operated only under contract. Thus like contract commuter rail service they would not affect the deficit assessed on the MBTA district.

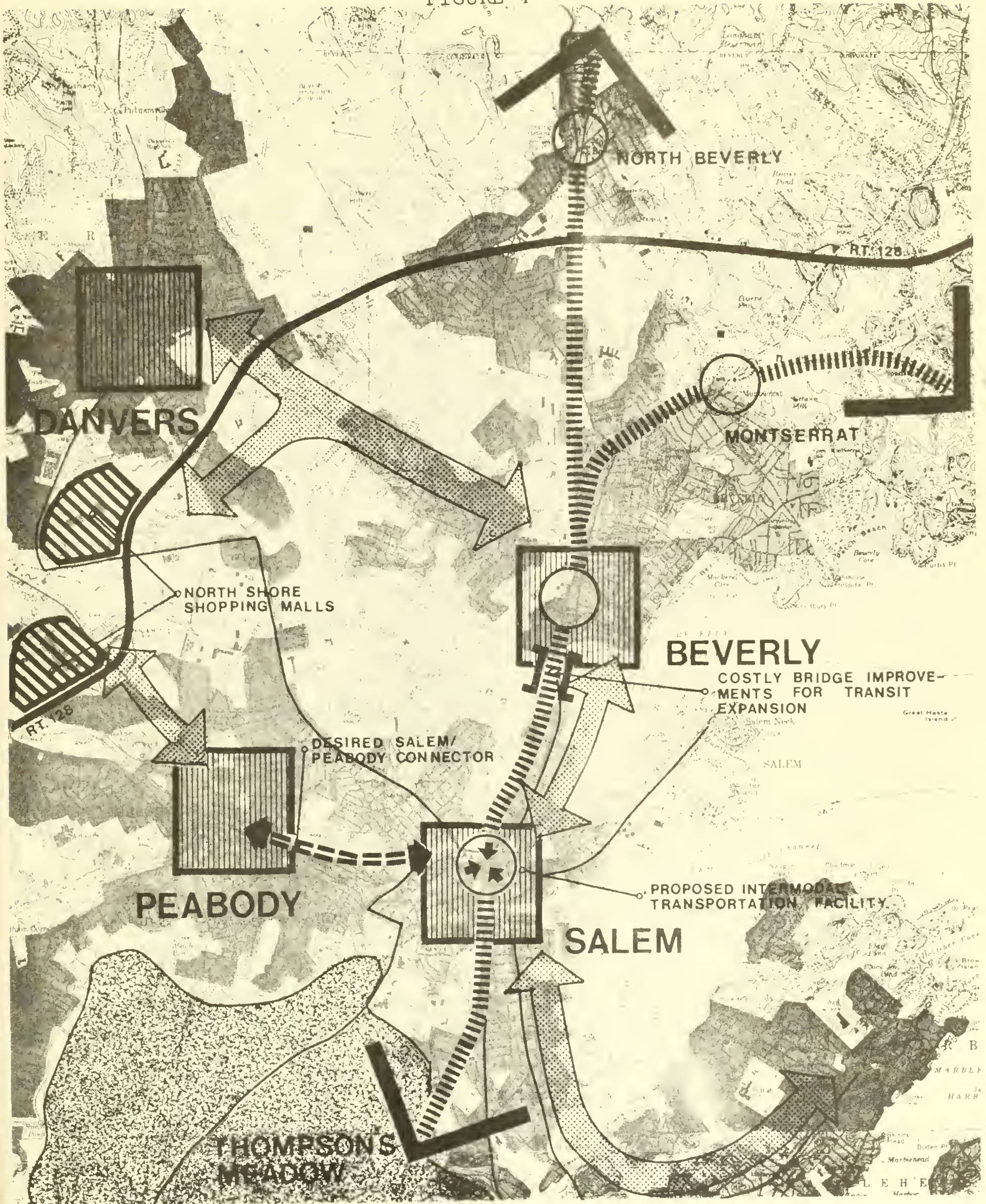
Twelve routes were proposed by the Simpson & Curtin Plan to replace commuter rail service on the Eastern Route main line and Rockport Branch. Of these routes 7 would have operated only during peak periods, 3 during off-peak hours only and two during both peak and off-peak hours. These routes would have served all existing Eastern Route stations within the MBTA district, but would not have served Gloucester, Rockport, or Ipswich, all of which are outside the MBTA district. The EOTC modification of the Simpson and Curtin plan would have ten routes, of which 6 would operate only during peak periods and three would operate only during off-peak periods. Service would be provided to the three communities outside the MBTA district as well as to the inside communities, assuming that the outside communities were willing to contract for this service.

In the EOTC analysis the performance of rail and bus services was measured in terms of running times and waiting times. For the rail service historical running times for well maintained track were used. For the replacement buses running times of existing bus routes were used wherever possible. Otherwise run times were based on times for buses under similar traffic conditions. Average waiting times for both bus and rail services were assumed to be one half of headway for headways up to 15 minutes and 7.5 minutes for longer headways.



SUB AREA 3  
CENTRAL COMMUNITIES

FIGURE 4





All waiting times were then weighted at 2.5 minutes for every actual minute to reflect the average user perception of off-vehicle time.

Due to the absence of limited access highway routes between North Shore points and Boston, minimum peak period running times for buses would exceed historical rail running times from all North Shore stations except for Gloucester and Rockport, even assuming trains make all stops. For trains operating non-stop between Beverly and Boston a further time advantage over bus is gained at all stations from Beverly north. Commuter rail schedule times vary little between peak and off-peak, but off-peak bus run time reductions of approximately ten minutes between outer North Shore points and Boston would occur as a result of lighter highway traffic. These reductions would result in bus times equal to or slightly less than rail times at North Beverly, Montserrat, and Manchester in addition to Gloucester and Rockport, but at all other stations off-peak bus running times would still exceed historical rail running times.

Bus services proposed by Simpson & Curtin and by EOTC for replacement of Eastern Route Commuter Rail are discussed below. Peak period is assumed to include arrivals in Boston between 7:30 and 9:00 A.M. and departures from Boston between 4:30 and 6:00 P.M., in conformance with existing commuter rail demand patterns.

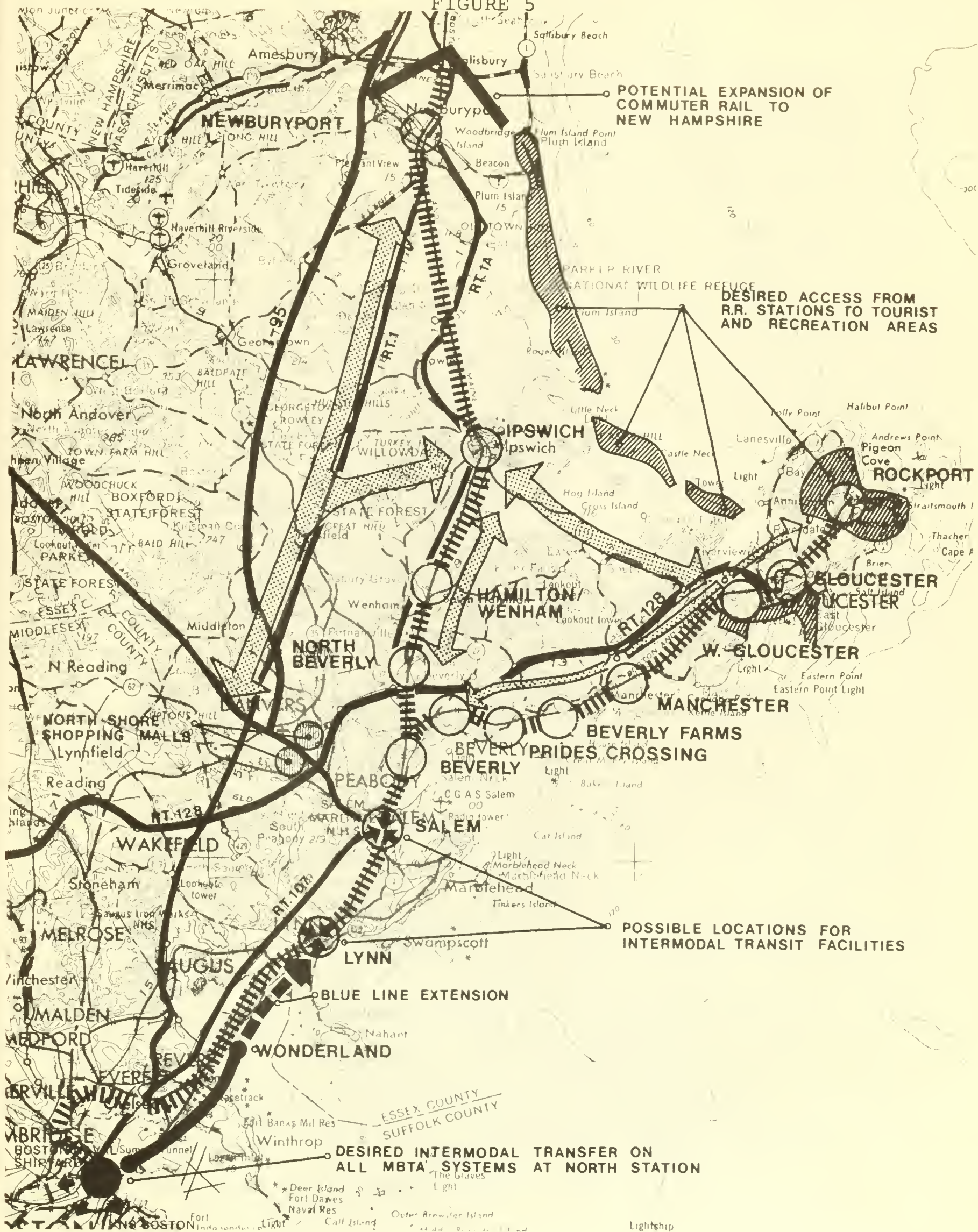
Current commuter rail boardings at Lynn are relatively small compared with those at other communities on the Eastern route. In 1974 80 daily riders boarded inbound trains at Lynn, and of these 50 to 60 boarded during the peak period. Six morning peak period trains stop at Lynn, compared to a total of 17 peak period buses to Boston via MBTA routes 400, 426, and 440. At the time the Simpson and Curtin report was prepared only routes 400 and 440 ran through to Boston. Simpson and Curtin proposed adding two peak-period trips to accommodate Lynn demand. The EOTC rail replacement plan does not provide service specifically for Lynn, but routes from certain stations further north would run via Lynn. Express bus alternatives for Lynn are treated elsewhere in Staff Report 5c.

The historical rail running time from Swampscott to Boston is 21 minutes. The best peak period bus running time from Swampscott to Boston would be approximately 38 minutes or a 17 minute increase over rail. During the peak period the existing rail headway at Swampscott averages 15 minutes. In order to equalize perceived rail and bus times at Swampscott peak bus headways of 1.4 min. would be required, but this



**SUBAREA 4  
NORTHERN COMMUNITIES**

**FIGURE 5**





would result in very low load factors. The Simpson and Curtin Plan proposed 20 min. peak and 30 min. off-peak bus headways from Swampscott to Boston, following MBTA route 440 west of the Swampscott town line. The EOTC plan attempts to offset some of the running time differential at Swampscott by assuming 5 minute peak departures. In the off-peak, instead of running a special bus, the EOTC plan would divert MBTA route 455 between Salem and Boston to serve Swampscott station. This route runs on a 30 minute mid-day and 60 min. evening headway.

The historical rail running time from Salem to Boston is 27 minutes. The best bus run time during peak period or mid-day hours would be 45 minutes, via MBTA route 450. The peak period rail headway at Salem currently averages 15 min. In order to equalize total perceived times of rail and bus, 30 second bus headways at Salem would be needed, but this is much more service than can be justified by the demand. The Simpson and Curtin Plan proposed a route from Salem to Boston combining portions of MBTA routes 455, 441, and 440, and providing service to Swampscott station in addition to buses originating there. EOTC analysis indicates that Simpson and Curtin significantly underestimated the run time for such a route, and that time from Salem to Boston that way would be 55 minutes or longer. The EOTC proposal assumes peak period headways of 5 minutes on Route 450 in addition to existing headways of 15-20 min. Off-peak service to Salem is assumed to be provided by existing trips on Route 450.

The historical rail running time from Beverly to Boston is 32 minutes for a local train or 26 minutes for an express train. EOTC analysis indicates that the fastest peak period bus time from Beverly to Boston would be approximately 50 minutes. This route would operate via Rtes. 128, and U.S. 1, the Northeast Expressway, and the Tobin Bridge. The proposed Simpson and Curtin route would have operated via McClellan Highway and the harbor tunnels instead of via the Northeast Expressway. The run time estimated for this route by Simpson & Curtin was 39 minutes but this time would not be attainable on a regular basis during peak hours. No possible peak period bus headway would equalize total perceived bus and rail times from Beverly. Simpson and Curtin proposed average peak period headways of 13 minutes from Beverly. The EOTC analysis indicates that with current demand at Beverly peak bus headways of 10.5 minutes would be needed to provide seats for all riders, assuming equal distribution between trips. The EOTC plan proposes 5 minute peak headways from Beverly to reduce user disbenefit and to allow for more random demand distribution. During off-peak hours the Simpson and Curtin proposal called for a local bus from Beverly to Boston via Salem every 30 minutes. The run time for such a route according to EOTC

analysis would be 58 minutes, or 26 minutes longer than local train time. The off-peak time for the routing used in the peak by EOTC would be 42 minutes. The EOTC rail replacement service would have off peak departures from Beverly via Route 128 and Route 1 every hour. This is the same headway as existing rail service but bus running time would be greater than rail time.

From North Beverly to Boston the historical rail running time is 36 minutes for a local train and 30 minutes for an express. From Hamilton & Wenham station to Boston the historical rail running time is 40 minutes for a local train and 34 minutes for an express. The minimum peak period bus time from Hamilton & Wenham to Boston would be 56 minutes via Rtes. 1A, 128 and U.S. 1, the Northeast Expressway, and the Tobin Bridge. This route would also serve North Beverly, with a run time of 43 minutes from there to Boston. At Hamilton and Wenham peak period bus headways of 2 minutes would be needed to equalize perceived bus time with perceived local train time. No headway would equalize perceived bus time with perceived express train time.

The Simpson and Curtin Plan called for 3 peak-period trips from Hamilton & Wenham to Boston via North Beverly and one additional trip to Boston from North Beverly only. In the off-peak service would have been operated every 2 hours. The EOTC proposal calls for a 9 minute peak period headway from Hamilton & Wenham serving North Beverly. This would result in average demand of 18 riders per trip. Although the 9 minute headway is more service than is needed for the existing volume, it is assumed in order to reduce user disbenefit of replacement service. During off-peak hours the EOTC proposal assumes bus headways of 2 hours, the same as current off peak rail headways. During off peak hours bus running times are ten minutes less than during peak hours, resulting in a reduced time disadvantage at Hamilton & Wenham and lower run time than local rail at North Beverly.

From Ipswich to Boston the historical rail running time is 48 minutes for a local train and 42 minutes for an express. The minimum peak period bus time from Ipswich to Boston would be 61 minutes via Rtes. 133 and U.S. 1, the Northeast Expressway, and the Tobin Bridge. A peak period bus headway of 4.5 minutes at Ipswich would be required to equalize perceived bus and local train time. The Simpson & Curtin plan did not include a proposal for serving Ipswich because it is outside of the MBTA district. The EOTC rail replacement plan calls for a 20 min. peak headway at Ipswich. This would result in average loads of 30 passengers per bus. Because both existing rail and proposed bus headways at Ipswich exceed 15 minutes, average wait time is assumed to be 7.5 min. for both in the EOTC analysis. During off-peak hours Ipswich would be served by extension of the bus route serving Hamilton & Wenham over Route 1A. This would result in a 63 min. off-peak run time from Ipswich to Boston.



From Montserrat to Boston the historical rail running time is 36 minutes for a local train and 30 minutes for an express train. From Prides to Boston the historical rail running time is 40 min. for a local train and 34 min. for an express. From Beverly Farms to Boston the historical rail running time is 42 min. for a local train and 36 min. for an express. EOTC analysis indicates that during the peak period the minimum bus times to Boston would be 46 minutes from Montserrat, 56 minutes from Prides, and 53 minutes from Beverly Farms. This would be accomplished by two routes running on Rtes. 128 and U.S. 1, the Northeast Expressway, and the Tobin Bridge. One route would serve only Montserrat. The other would originate at Prides and also serve Beverly Farms. The current daily rail ridership at Montserrat is approximately equal to demand at the other two stations. In terms of volume, a single route serving all three stations could justify headways half as long as those for two separate routes. This headway advantage of one through route would reduce total user time for riders from the three stations sufficiently to offset the increased run time from local travel between Prides and Montserrat. The EOTC plan assumes a single peak period route serving Beverly Farms, Montserrat, and Prides on a 10 min. headway. This frequency is greater than needed to carry the existing volume, but is not sufficient to equalize perceived bus and rail times at any of the three stations. The Simpson & Curtin plan called for 2 peak period trips serving all three stations and one trip serving Montserrat only. During off-peak hours the bus running times to Boston from all 3 stations would decrease by approximately 10 minutes. This would make bus time less than rail time at Montserrat but not at the other two stations. Both the Simpson and Curtin plan and the EOTC plan assume 2 hour off-peak headways from Beverly Farms to Boston via Prides and Montserrat.

From Manchester to Boston the historical rail running time to Boston is 47 minutes for an express train and 41 minutes for a local. The minimum bus running time would be 55 minutes over a route serving only Manchester station and running into Boston via Rtes. 128 and U.S. 1, the Northeast Expressway, and the Tobin Bridge. A peak bus headway of 8.5 minutes would be needed to equalize total perceived times for bus and local rail at Manchester. In the EOTC proposal a 9 minute headway is assumed. The Simpson and Curtin plan called for 3 peak period trips from Manchester to Boston. During the off peak the Simpson and Curtin plan called for a 2 hour headway from Manchester with the same route providing all off-peak service at Beverly Farms, Prides and Montserrat. The EOTC proposal assumes a 2-hour off-peak headway at Manchester, but provided by a bus from Rockport and running express from Manchester to Boston.



The historical rail running time to Boston from Gloucester is 60 min. local and 54 min. express. From Rockport to Boston the historical rail running time is 64 min. local and 70 min. express. The Simpson & Curtin plan did not provide for service to either of these stations because they are outside of the MBTA district. The EOTC plan would serve both stations assuming that the two towns were willing to contract for the service. West Gloucester station would not be served due to low ridership. The minimum peak period bus times to Boston would be 61 min. from Gloucester and 71 min. from Rockport. Both of these times are only 1 min. longer than the corresponding local service rail times to Boston. The EOTC proposal, therefore, does not attempt to equalize bus and rail times at Rockport and Gloucester but instead bases frequency on volume. Two separate routes are assumed in the peak period. One would run from Gloucester to Boston on a 20-min. headway, and the other from Rockport to Boston on a 30-min. headway. During the off-peak a single route serving Rockport, Gloucester, and Manchester would be run on a 2-hour headway.

In 1974 the avoidable cost of weekday commuter service on the Eastern Route main line and the Gloucester Branch was \$2,525,000. An additional \$890,000 of fixed costs associated with overall B&M operations was allocable to the Eastern Route using B&M formulas, but most of this amount would remain unless service on all B&M lines were discontinued. The estimated cost of the weekday service proposed by EOTC as a replacement for the Eastern Route service would be \$4,055,000 per year in terms of 1974 MBTA unit costs. This is \$640,000 per year greater than the fully-allocated costs of the Eastern Route rail service, and \$1,530,000 greater than the avoidable cost of this rail service. Additionally this service would result in a net increase of \$457,000 per year in user time costs.

The service proposed by EOTC was designed to minimize increases in user time costs whenever feasible. However this results in a rather expensive network with low utilization. An alternate scheme would be to operate buses at frequencies required to provide seated rides for all current rail users in the peak, and to match rail headways during the off-peak. This would reduce the bus system operating cost to approximately \$2,400,000 per year. However it would increase user time costs by an additional \$283,000 to a total of \$740,000 per year. Thus replacement of commuter rail by a conservative bus network would result in new operating and user time costs of \$3,140,000 per year while saving only \$2,525,000 in rail operating costs.

### III.E.2. Improved Commuter Rail

a. Advantage of commuter rail over alternatives. The analysis in Section III.E.1. showed that in the North Shore corridor minimum peak period bus running times to Boston from existing railroad station sites would exceed running times possible with trains given well-maintained track, bridge, signals, etc. Although in some cases this running time disadvantage of buses could be compensated for by more frequent departures, the resulting bus system would be more expensive to operate than the rail system. The combined operating costs and net user disbenefits of a bus system designed only on a capacity basis would also exceed rail operating costs.

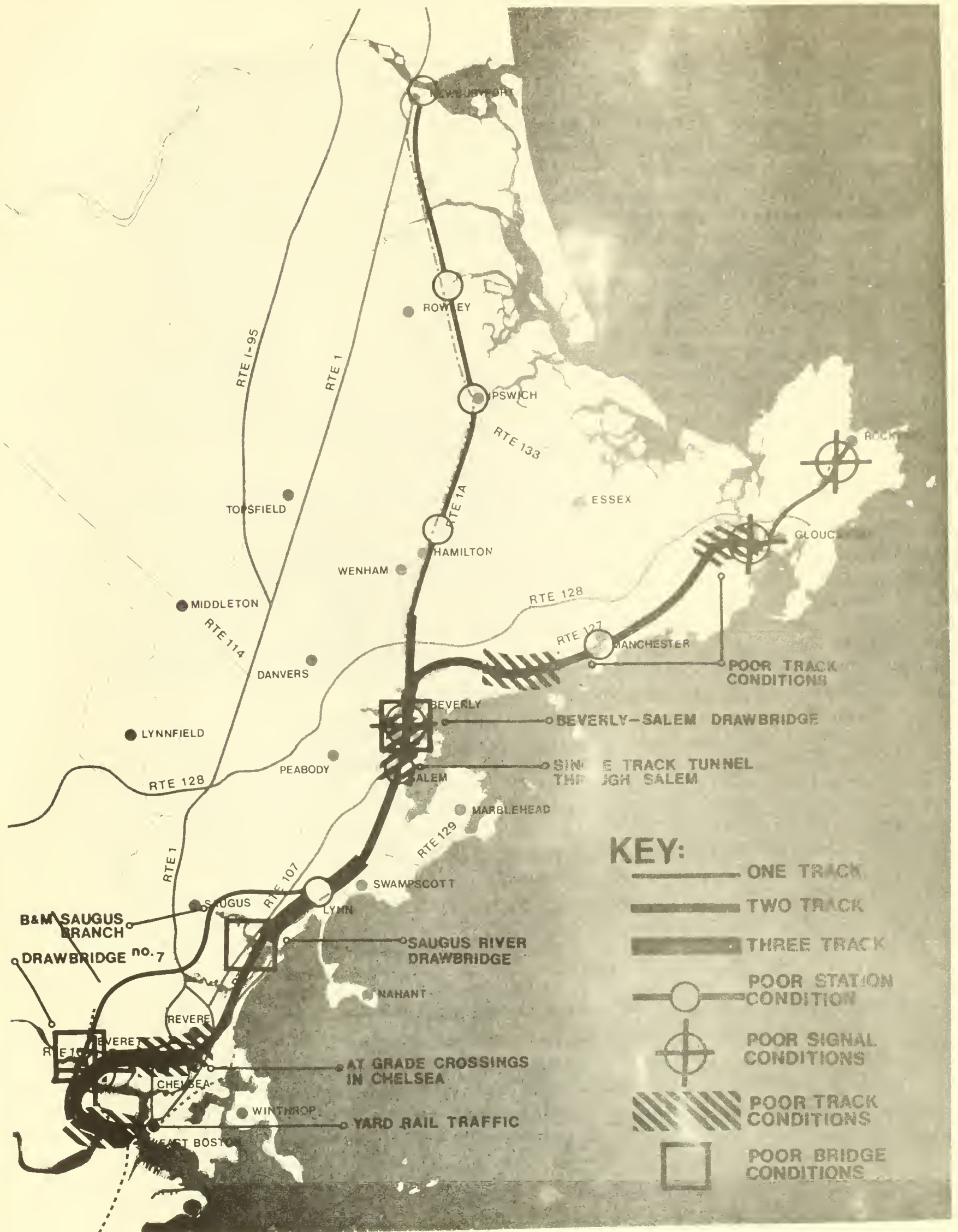
Due to the bankruptcy of the Boston and Maine Corporation the condition of track and structures on the Eastern Route Mainline and Rockport Branch was allowed to deteriorate seriously during the late 1960's and early 1970's, with the result that operating speeds for trains had to be reduced significantly. As of June 1975 the scheduled run time from Rockport to Boston for a local train was 84 minutes compared to 70 to 72 minutes in 1963. The local run time from Ipswich to Boston in June 1975 was 62 minutes compared to 48 minutes in 1963. Even with these running times, however, peak period rail schedules to Boston were faster than the best potential peak period bus schedules to Boston from most North Shore rail stations.

b. Recent Improvements on Eastern Route. During the latter half of 1975 a limited tie and ballast renewal program was carried out on the Eastern Route between the Mystic River Crossing in Everett and Beverly Junction, using a combination of federal funds obtained under the Public Works and Economic Development Act; Boston and Maine funds, and MBTA funds. This work was sufficient to raise the maximum speed limit on the track involved from 50 mph to 60 mph, but speed restrictions resulting from grade crossings and old bridges remain within the segment. Additional tie and ballast work will be needed in order to maintain the new speed limit on a long range basis.

Effective with the Spring 1976 timetable the scheduled running time from Beverly to Boston will be reduced from 41 to 35 minutes, and further reductions will take place if the 35 minute run time proves reliable. At the same time a shuttle service between Beverly and Boston will be implemented in addition to Ipswich and Rockport service. This will result in a shortening of mid-day headways south of Beverly from 60 to 30 minutes.



FIGURE 6  
PROBLEM AREAS ON COMMUTER RAIL ROW





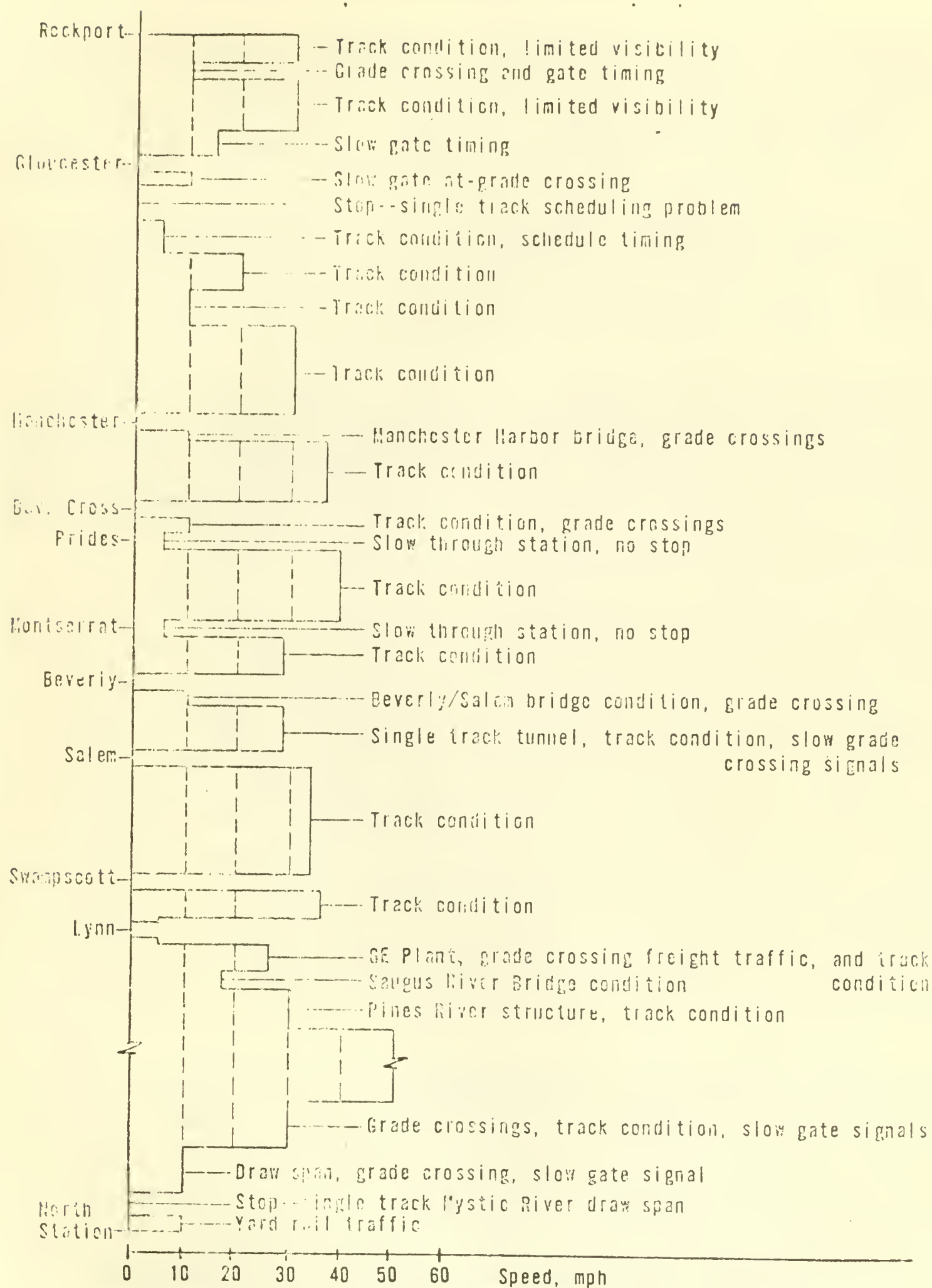
c. Rolling Stock Options. In terms of the long range future of commuter rail service on the Eastern Route Mainline and Gloucester Branch a number of options are available. Assuming no drastic change in the character of industry in the North Shore corridor, railroad freight service must be maintained on the Eastern Route main line at least from Boston to Beverly. Therefore any option selected for upgrading of commuter service on the Main line and Gloucester Branch must be compatible with continued freight service. At present all commuter service on the Boston and Maine is provided with self-propelled Rail Diesel Cars (RDC's) manufactured by the Budd Company between 1952 and 1958. New Budd RDC's have not been built since 1962, and the B&M fleet is becoming increasingly expensive and difficult to maintain. The existing cars will be upgraded as part of the Commuter Rail Improvement Program (CRIP) but the extent of rehabilitation and its impact on life expectancy of the RDC's will not be known until the Rolling Stock Study being conducted under the CRIP program is completed.

Several vehicle technology options exist for improving commuter rail service. One alternative is to phase out the existing Budd cars and replace them with new commuter rail passenger cars. Some self-propelled diesel-electric and gas turbine-electric vehicles currently manufactured will be examined in more detail in the Phase II analysis. That study also will focus on the possibility of using double-decker coaches to reduce labor costs, and will explore the feasibility of employing diesel locomotives and passive passenger coaches for combination in a "push-pull" fashion.

A second option consists of electrifying the B&M Eastern Route and Gloucester branch with overhead catenary or third rail and using electrically-powered vehicles. Electrification offers many advantages in terms of reduced maintenance and operating costs, but the initial capital investment appears to make it prohibitively expensive. The cost of electrification would vary between seven and ten million dollars for the Eastern Route and Gloucester Branch, excluding signals, communications, and rolling stock. This option may be examined in more detail for the Phase II upgraded commuter rail alternative.

d. Right of Way Constraints. The total length of the Eastern Route main line now having passenger service is 27.8 miles, with an additional 16.6 miles on the Gloucester branch. The right-of-way widths are shown in Figure 2. The 4-track segment through Everett and Chelsea is not wholly owned by the B&M, but the right-of-way is wide enough to accommodate rapid transit tracks. The two-track right-of-way in the Saugus Marsh is adjacent to an electric power line which would have to be relocated if right-of-way widening were contemplated.

FIGURE 7  
TYPICAL B&M RR SPEEDS AND REASONS



From the Saugus River to the Lynn-Swampscott boundary, the right-of-way is four tracks wide, so few problems would be encountered by adding rapid transit. In Salem, there is a single-track tunnel which constitutes a barrier to further extensions of rapid transit on the B&M right-of-way. The Rail Diesel Cars operate over private right-of-way for the entire length, but the track is completely grade separated only in Revere, Lynn, Swampscott, and Salem. On both branches there is a total of 69 at-grade crossings and 67 grade-separated structures. Any major improvements in rail operations would most likely require significant amounts of engineering and construction work at many of the at-grade locations.

e. Restrictions on Operating Speeds. Figure 7 shows the speed limits in effect on the Eastern Route from Boston to Rockport prior to the 1975 rehabilitation work between the Mystic River and Beverly Junction. Speed restrictions on that segment that were caused solely by track conditions have now been removed, resulting in overall top speeds of 60 mph. However speed restrictions north of Beverly Junction remain in effect. As can be seen from Figure 3 the most prevalent cause of restricted speeds is poor track condition. Other causes of speed restrictions are weakened bridges, and inadequate grade crossing protection. Due to construction of the MBTA's Haymarket North Extension of the Orange line B&M, Reading line trains must now operate over Eastern Route trackage between North Station and Reading Junction, a distance of 1.4 miles. This results in some scheduling problems during peak periods. The Eastern Route tracks cross the Mystic River at the Everett City line on two parallel draw spans. Currently the westbound span is out of service pending repairs and trains in both directions are operated over the remaining track between Reading Junction and Everett Junction, a distance of 0.9 miles. In the past the overall maximum speed limit on all track north of the Mystic River has been as high as 60 mph, but there have always been lower limits at various crossings, bridges, junctions, and curves.

f. Potential Track and Structure Improvements. Most of the speed restrictions attributed to track conditions on the Eastern Route could be removed by renewal of ties and ballast. About two thirds of the ties on the Main line and Gloucester branch north of Beverly Junction should be replaced if long range restoration of 60 mph speeds is to be achieved. South of Beverly Junction about 25 per cent of the ties are still in need of replacement. Most of the rail on the Eastern Route is still in good condition but some replacement is needed on the Gloucester Branch. In order to remove all speed restrictions over the Charles, Mystic, Pines, Saugus, and Danvers Rivers, entirely new bridges would be needed and Annisquam River Bridge in Gloucester would require improvements.



g. Salem Intermodal Terminal. Local planners have been considering an intermodal station facility at the northern end of the tunnel in Salem. The North Shore Study Team has reviewed this project and have recommended it as a major improvement in the central community area. This would allow transfers between rail, bus and private auto.

Improved transit service such as this would serve as a "bonus" in economic terms, by aiding what has been the healthiest development sub-sector the North Shore has seen in recent years.

The project consists of relocating the present Salem Rail Station from the southerly end of the Salem Tunnel (at Riley Plaza) to a location at the north end of the tunnel at Bridge Street. The complex would include a parking garage, bus terminal and a commuter rail station, with potential for commercial development on the site.







